622
27
TN
122
S7A3
no.27
Physical &
Applied Sci.
Serials
Engineering
ENGINEERING STORAGE

South Australia.

BUREAU OF MINES
RECEIVED
JUL 10 1918

DEPARTMENT OF MINES.

MINING REVIEW

FOR THE

HALF-YEAR ENDED DECEMBER 31st, 1917.

LIBRARY
JAN 9 1969
UNIVERSITY OF TORONTO

No. 27.

DO NOT REMOVE
FROM THIS ROOM

Compiled by LIONEL C. E. GEE, S.M., Chief Registrar and Recorder, Department of Mines.

ISSUED UNDER THE AUTHORITY OF THE

HONORABLE JOHN G. BICE, M.L.C.,

Minister of Mines,

By F. C. WARD, J.P., *Secretary for Mines.*

DEPARTMENT OF GEOLOGICAL SCIENCES,
UNIVERSITY OF TORONTO

Adelaide:
R. E. ROGERS, GOVERNMENT PRINTER, NORTH TERRACE.

1918.

South Australia.

DEPARTMENT OF MINES.

MINING REVIEW

FOR THE

HALF-YEAR ENDED DECEMBER 31st, 1917.

No. 27.

Compiled by LIONEL C. E. GEE, S.M., Chief Registrar and Recorder, Department of Mines.

ISSUED UNDER THE AUTHORITY OF THE

HONORABLE JOHN G. BICE, M.L.C.,

Minister of Mines,

By F. C. WARD, J.P., *Secretary for Mines.*

Adelaide:

R. E. E. ROGERS, GOVERNMENT PRINTER, NORTH TERRACE.

1918.

Miners' Rights and Privileges thereunder.

A miner's right is obtainable at the Department of Mines, Adelaide, also at the issuing stations in the various mining districts, at a cost of 5s.; it is in force for one year from the date of issue, and may be renewed at any time during its currency for another term of one year on payment of 5s. The holder is authorised to prospect on any mineral lands for any metal, mineral, coal, or oil, and to peg out (of the prescribed shape and dimensions) gold, mineral, coal, and oil claims, and also leases of a like nature.

AREAS AND WORKING CONDITIONS.

GOLD LEASES—Maximum area, 20 acres; working conditions, one man to every five acres.

MINERAL LEASES—40 acres; one man to every 10 acres.

MISCELLANEOUS LEASES—

Salt	640 acres;	special conditions.
Gypsum	640 "	"
Mining Works	10 "	one man.
COAL OR OIL LEASES	640 "	one man to every 40 acres.
GOLD DREDGING LEASES	200 "	special conditions.
MINERAL CLAIMS	40 "	
GOLD CLAIMS	30ft. x 30ft., alluvial; 100ft. x 600ft., reef.	

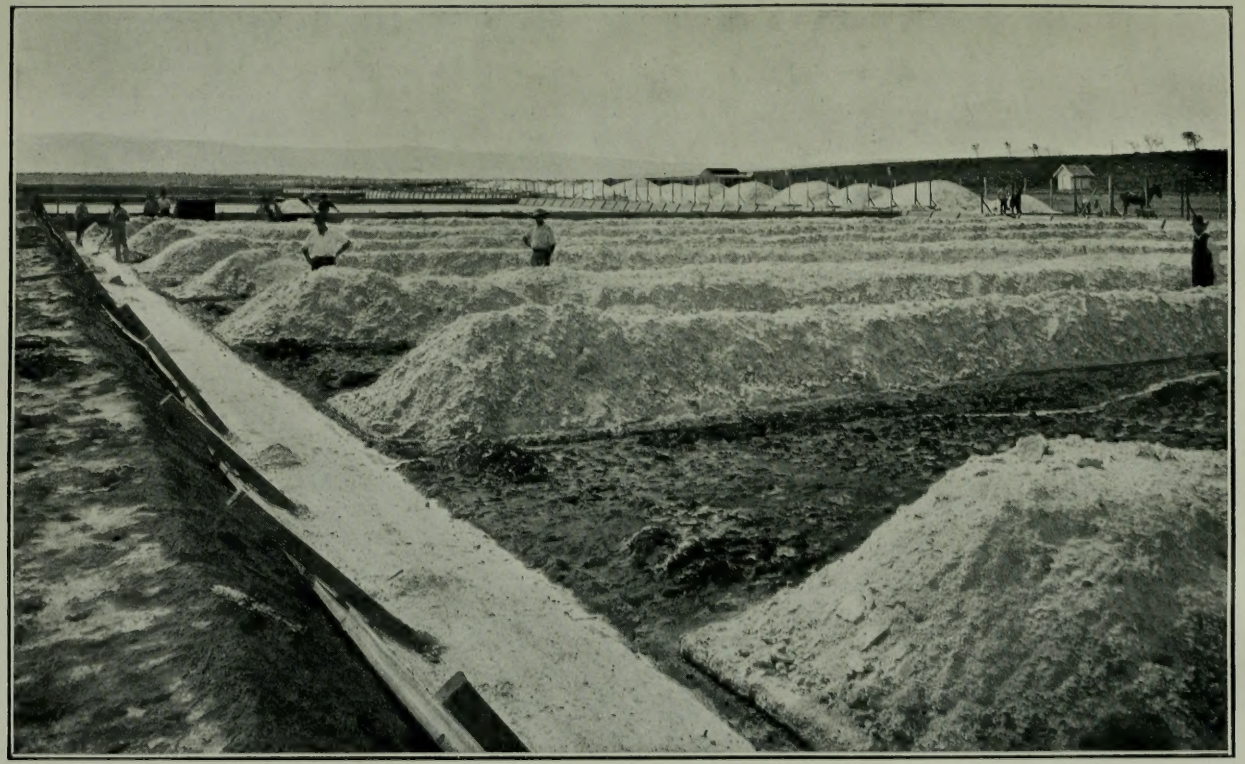
Gold claims must be constantly worked—one man for each claim—and mineral claimholders must employ two men for each claim. Amalgamation of either gold or mineral claims reduces the labor conditions by one-half until payable results have been obtained.

Gold, mineral, coal, and oil leases are granted for a term not exceeding 42 years—the two former at a rental of 1s. per acre per annum and a royalty of 6d. in the pound on net profits, the latter at a rental of 6d. per acre per annum until coal or oil is found in payable quantities, when 1s. per acre is payable and a royalty of 6d. in the pound on the net profits.

The Minister may permit, for the concentration of labor, of the amalgamation of not more than four adjoining gold or mineral leases.

Any number of gold, mineral, coal, or oil leases may be held by one person.

Licences to search for twelve months for precious stones, mineral phosphates, oil, rare metals, minerals, and earths are issued on specific mineral lands, not exceeding five square miles in area for one person, a fee of 20s. being charged for each square mile or portion thereof. These licences give a preferential right to a lease over a portion of the area, as prescribed.



SALT OBTAINED BY EVAPORATION OF SEA WATER, AT THE HEAD OF SPENCER'S GULF.
CRYSTAL SALT, LIMITED.

Mining on Private Property.

The procedure necessary under the Private Property Act and the Amendment Act of 1916 is now according to the following summary :—

(1) The prospector will obtain a Miner's Right.

(2) He will obtain a written authority to enter from the Minister or a Warden or Mining Registrar with whom it is necessary for him to lodge an arranged deposit as security against possible damage. Before actually entering upon the private land, three days' clear notice in writing must be given to the owner and occupier. The authority entitles the prospector to prospect for a period not exceeding 14 days on an area not exceeding one square mile ; also to make trenches and sink holes, provided that the area of the surface broken by such operations does not exceed 100 sq. ft. The prospector may also remove samples not exceeding 28lbs. in weight. If he is satisfied he may peg out the area which he desires to have included in a claim or lease.

(3) The prospector then endeavors to make a private arrangement with the owner of the property for the working of the mineral deposit, and failing to arrive at a satisfactory agreement with the owner, he applies for a compulsory mining lease.

(4) On the granting of such lease the work of mining or actually raising ore for sale can be commenced.

All arrangements for entry and for mining can be made, if feasible, between the prospector and the owner of the freehold without reference to the Mining on Private Property Acts.

The right formerly possessed by the owner of the land to work the property himself within a period of two months by complying with the necessary working conditions no longer exists.

PREFACE.

THE value of the mineral production of the State for the year 1917, so far as can be ascertained, is £1,460,674, the highest total yet reached being £247,800 more than the value for 1916, which was the previous record amount—this is mainly due to the high price of copper and the large quantity of iron ore produced.

The heavy rains throughout last year considerably affected the output of salt and gypsum—about 700 tons of coal was raised by this department from the Leigh Creek Coal Mine, and special attention is called to a report on the Leigh Creek Coal Field by the Government Geologist and the Chief Inspector of Mines, which is published in this issue.

An encouraging report by the Assistant Government Geologist on his third inspection of the Graphite localities in Eyre Peninsula is also published.

LIONEL C. E. GEE,

Chief Registrar of Mines.

February 27th, 1918.

INDEX

	PAGE
Accidents, Mines and Quarries	30
Ajax C.M.	81
Arsenic	11
Assays, School of Mines	30
Assistant Government Geologist—Reports by	52–67
Battery Returns	19–20
Battery Returns (State)—Summary of totals to 31/12/17.	21–23
Belliak C.M.	79
Billy Springs	80
Bingo C.M.	9
Big Lode (Mont Pelee) C.M.	77
Black Eagle C.M.	81
Bonus for Discovery of Oil	17
Bonus for Production of Graphite	18
Boorthanna	9
Butler's Manganese Show, Hundred Parnaroo	68
Chief Inspector of Mines, Reports by	34, 68–82
Coal, Leigh Creek	11
Coal, Leigh Creek Field—Report by Government Geologist and Chief Inspector of Mines	34–51
Copper Mining, Localities of	9
Copper, Prices of	8, 23
Copper King C.M.	81
Copper Queen C.M.	81
Crushing and Cyaniding Plants	19
Decennial Returns	6
Deloraine G.M.	10, 20
Diamond Drilling Operations	24
Diamond Jubilee C.M.	74
Dustholes G.M.	10
Eastern Shaft (Yelta)	9
General Notes	8
Glenloth Government Plant	20
Government Geologist, Report by	34–51
Graphite	12
Graphite, Bonus for Production of	18
Graphite, Eyre Peninsula—Report by Assistant Government Geologist	52–65
Great Mount Lyndhurst C.M.	79
Gypsum	11
Haklo G.M.—Report by Assistant Government Geologist	65
Hidden Secret G.M.	10
Holmes's Block	74
Holmes's Claim	76
Hutchison, Hundred of—Graphite	64
Kanmantoo C.M.	70
Kitticoola	20
Koppio, Hundred of—Graphite	62
Lady Alice G.M.	11
Last Chance C.M.	79
Leigh Creek Coal Mine	11
Leigh Creek Coalfield, Report on, by Government Geologist and Chief Inspector of Mines	34–51
Leslie's Well C.M.	76
Louth, Hundred of—Graphite	62
Lynda C.M.	76
Medora G.M.	10
Metallurgical Laboratory	12
Miltalie, Hundred of—Graphite	64
Mountain of Light C.M.	75
Mont Pelee	77
Mount Burr C.M.	78
Mount Fitton South C.M.	80
Mount Grainger G.M.	10
Mount Gunson C.M.	9
Mount Malvern	11
Mount Torrens Government Plant	19
Mount Rose C.M.	80
Mount Lyell Consols (Wallaroo)	9
Miners' Rights, and Privileges thereunder	2
Mining on Private Property	3
Mining Operations during Half-year	7
Molybdenite	9
Myrtle G.M.	10
Nichol's Nob C.M.	77
Niddrie	75
Oil, Bonus for Discovery of	17
Olivaster S.L.M.	11
Ore, Tests of	13
Parabarana C.M.	69
Paull's Consolidated C.M.	81
Paull's North	81
Peterborough Government Plant	19
Phosphate Rock	12
Potash—Legislation relative thereto	13
Reports	8
Reports by the Government Geologist.	34
Reports by the Assistant Government Geologist	52
Reports by the Chief Inspector of Mines	34–68
Salt	11
Sampling, Notes on	31–33
Sleaford, Hundred of—Graphite	55
Sliding Rock C.M.	82
Subsidies	27
Tarcoola Blocks G.M.	10
Tarcoola Government Plant	19
Tests of Ore	13
Two Jacks	82
Uley, Hundred of—Graphite	58
Union Consolidated Co.	9
Wadnaminga	10
Wallaroo and Moonta	9
Wanilla, Hundred of—Graphite	61
Warrioota	82
Wild Dog Shaft (Yelta)	9
Yelta C.M.	9
Yudnamutana	9

DECENNIAL RETURN SHOWING, SO FAR AS CAN BE ASCERTAINED OUTPUT AND VALUE OF VARIOUS METALS AND MINERALS PRODUCED IN SOUTH AUSTRALIA.

Year.	Gold.		Silver.		Silver Lead Ore.		Copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Ounces.	£	Ounces.	£	Tons.	£	Cwts.	£
1908	2,908	12,300	—	—	900	9,000	112,554	338,000
1909	7,111	30,206	1,660	167	70	416	113,940	334,584
1910	6,603	28,000	6,250	625	25	22	102,040	306,120
1911	3,537	15,000	1,400	140	—	—	118,440	332,500
1912	6,592	28,000	2,700	326	—	—	125,900	461,500
1913	6,556	27,800	2,650	300	153	1,100	143,222	488,986
1914	6,258	26,581	3,006	314	18	215	137,614	417,487
1915	6,081	25,830	2,462	277	59	625	154,506	561,247
1916	7,769	33,000	3,427	514	243	4,659	145,580	822,527
1917	7,145	30,334	1,825	333	622	12,018	144,262	902,495
Totals....	—	257,051	—	2,996	—	28,055	—	4,965,446

Year.	Copper Ore and Regulus.		Lead.		Ironstone.		Limestone.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Cwts	£	Tons.	£	Tons.	£
1908	—	—	—	—	88,000	39,600	29,500	6,000
1909	1,230	4,003	140	90	16,120	8,296	13,765	2,464
1910	—	(*a*) 9,350	400	260	46,200	21,945	18,600	3,720
1911	—	(*b*) 11,103	—	—	42,300	26,400	28,700	7,175
1912	—	(*c*) 10,192	—	—	42,200	26,375	50,600	12,500
1913	—	(*d*) 8,308	—	—	60,658	37,911	44,300	11,075
1914	—	(*e*) 8,910	—	—	42,622	37,137	54,054	16,892
1915	—	(*f*) 13,490	—	—	237,375	264,612	71,723	22,413
1916	—	(*g*) 10,378	—	—	188,329	200,382	74,641	23,325
1917	—	(*h*) 8,820			328,386	359,723	68,464	21,395
Totals	—	84,554	—	350	—	1,022,381	—	126,959

Year.	Phosphate Rock.		Crude Salt.		Other Metals and Minerals.	Total Value.
	Quantity.	Value.	Quantity.	Value.	Value.	
	Tons.	£	Tons.	£	£	£
1908.....	11,000	11,000	75,000	37,500	4,500	457,900
1909.....	3,772	3,697	51,407	25,594	3,873	413,390
1910.....	5,200	5,200	54,000	27,000	(*i*) 13,600	415,842
1911.....	5,800	5,800	65,000	40,600	(*j*) 11,319	450,037
1912.....	6,100	6,100	64,300	40,187	(*k*) 10,490	595,670
1913.....	5,950	6,545	65,000	48,750	(*l*) 11,851	642,626
1914.....	6,083	6,691	65,000	48,750	(*m*) 37,378	600,355
1915.....	4,614	5,536	64,000	80,000	(*n*) 27,855	1,001,885
1916.....	5,013	5,839	66,400	83,000	(*o*) 29,250	1,212,874
1917.....	5,101	6,064	46,858	93,716	(*p*) 25,776	1,460,674
Totals	—	62,472	—	525,097	175,892	7,251,253

(*a*) Bluestone, £5,980; Sulphuric Acid, £3,370.
(*b*) " £4,163 " £6,940.
(*c*) " £2,550 " £7,642.
(*d*) " £325 " £7,983.
(*e*) " — " £8,910.
(*f*) " £69 " £13,421.
(*g*) " £10,378.
(*h*) " £8,820.
(*i*) Including Gypsum, £9,000; Pyrites, £3,270.
(*j*) " £7,275; " £2,580.
(*k*) " £9,000.
(*l*) " £5,362; Radium and Radio-Active Material, £3,620
(*m*) " £12,207; Kaolin, £16,382.
Radium and Radio-Active Material, £5,215.
(*n*) " £17,413; Kaolin, £1,934; Fireclay, £5,374; Barytes, £1,320.
(*o*) " Gypsum, £17,825; Barytes, £2,052; Manganese, £2,700; Opal, £750; Kaolin, £2,616; Fireclay, £1,204.
(*p*) " Gypsum, £11,179; Kaolin, £3,442; Barytes, £2,370; Manganese, £1,597; Opal, £500; Flint Pebbles, £3,956; Molybdenite, £359; Mica, £337.

Mining Operations during the Half-year ended December 31st, 1917.

AREA AT PRESENT HELD UNDER MINING ACTS (DECEMBER 31ST, 1917).

Nature of Holding.	Number.	Area.
Mineral leases	305	14,314 acres
Gold leases	83	1,509 "
Miscellaneous leases	62	12,994 "
Coal and oil leases	4	1,360 "
Mineral claims	401	13,260 "
Occupation licences	218	109 "
Search licences	118	217,647 "
Coal and oil claims	20	12,800 "
Gold claims	3	10 "
Total holdings	1,214	274,003 acres

REGISTERED FROM JULY 1ST, 1917, TO DECEMBER 31ST, 1917.

Mineral leases	13	482 acres
Gold leases	8	158 "
Mineral claims	129	4,456 "
Coal and oil claims	17	10,880 "
Occupation licences	6	3 "
Search licences	87	176,000 "
Miners' rights	551	—
Total	811	191,979 acres

MEN EMPLOYED.

Estimated number of men employed in mining and mineral works, December 31st, 1917 :—

Copper	2,000
Gold	150
Salt and Gypsum	400
Other minerals	250
Smelting works, etc.	2,600
Total	5,400

GENERAL NOTES.

Assistance from the Prospecting Vote has been granted to the following mines :—

David Copperfield (copper), hundred Onkaparinga.
Poonana (copper and silver lead), hundred Mann.
Tarcoola Blocks (gold), Tarcoola.

Reports by the Government Geologist and the Chief Inspector of Mines will be found—

	Page.
Report on Leigh Creek Coal Field	34
By the Assistant Government Geologist—	
Third Inspection of the Graphite Localities of Eyre Peninsula	52
Haklo, Section 6396, *Hundred Talunga* (*Gold*)	66
By the Chief Inspector of Mines—	
Butler's Manganese Show, Section 179, *Hundred Parnaroo*	68
Parabarana (copper)	69
Kanmantoo (copper)	70
Diamond Jubilee (copper)	74
Holmes' Block (copper)	74
Holmes' Claim (copper)	76
Mountain of Light, &c. (copper)	75
Niddrie	75
Leslie's Well (copper)	76
Lynda (copper)	76
Nichol's Nob (copper)	77
Big Lode (*Mount Pelee*) (copper)	77
Mount Burr (copper)	78
Belliak (copper)	79
Great Mount Lyndhurst (copper)	79
Last Chance (copper)	79
Mount Fitton South (copper)	80
Billy Springs (copper, lead, silver, and zinc)	80
Mount Rose (copper)	80
Paull's Consolidated (copper)	81
Copper Queen (copper)	81
Black Eagle (copper)	81
Two Jacks and Warrioota (copper)	82
Sliding Rock (copper)	82

The average price of standard copper for the six months is £116 12s. 3d., and for electrolytic £129 5s. The range of prices is—

Standard.	£	*s.*	*d.*
Highest, July 14th	131	5	0
Lowest, October 3rd	110	5	0
Electrolytic.			
Highest, July 14th	140	0	0
Lowest, October 3rd	123	0	0

The output is disposed of to the Imperial Government and munition makers, and from October onward the fixed price per ton has been—Standard, £110 5s.; and electrolytic, £123.

The output for the year 1917 is estimated at 144,262cwts., which, at the average price of standard copper for year, is worth £902,490.

The bulk of this comes, of course, from the Wallaroo and Moonta Company, which employs over 1,900 hands, and which, despite the surrounding war-time difficulties, has maintained its high reputation as a copper producer.

Tributing operations continue at the *Yelta Mine*, and also at the *Wild Dog* or *Eastern* Shaft.

Work at the *Mount Lyell Consols Wallaroo* (*formerly the Bingo Mine*) consisted of the erection and completion of pumping and winding plant and buildings and the cleaning of the shaft.

At *Mount Gunson* ore is being raised, and 636 tons have been forwarded to market from the mine.

Small parcels of ore continue to be forwarded from claims in the vicinity of *Boorthanna* to the Wallaroo Smelting Works. A total of 65 tons yielded 12½ tons of copper.

On the *Yudnamutana* mines the *Union Consolidated Company* has done some work at *The Daly, Old Noll, Black Queen, Yuda,* and *Gleeson,* and also marketed 41 tons of 22 per cent. to 35 per cent. ore.

In addition to the mines above-mentioned, returns show that a little mining has been done at the following copper shows:—

North.—Baroota, Barilla, Black Eagle, Boulder Blocks, Big Lode, Copper Queen, Depot Creek, Diamond Jubilee, Dorris Fabian, Hamilton, Kapunda, Last Chance, Leslie's Well, Mountain of Light, Mount Burr, Nichol's Nob, Nichol's Nob North, Nuccaleena, O'Donoghue's Castle, Paull's, Warra Warra, West Burra.

North-East.—Anabama, Baratta, Cutana, Paratoo, Lovely Gully.

North-West.—Sweet Nell.

West.—Tumby Bay.

South.—Kanappa.

Molybdenite.—During the half-year the tributers working on the *Yelta Mine* recovered 10 bags of molybdenite weighing 7cwts. 0qrs. 3lbs.

The same party previously recovered 9 bags, having a net weight of 5cwts. 1qr. 3lbs., in the latter part of 1915.

During the period in which the Yelta Mine was worked by the State 6cwts. 2qrs. 9lbs. were sold.

This molybdenite occurs in bunches scattered through the copper ore of the Yelta Mine, and is picked out during the dressing of the copper ore. It is further dressed by hand, and the last parcel sold contained 95 per cent. of molybdenite.

The *Deloraine Gold Mine*, near Kersbrook.—The returns from the Deloraine, the brightest mining spot, at present, in the Mount Lofty Ranges, continue regular and satisfactory. The total value of the production for this half-year from 2,561 tons of ore being £7,044, against £6,396 from 2,524 tons treated during the previous six months. This also shows an appreciation in the value of the gold bullion.

The manager supplies the following summary of operations for six months ended December 31st, 1917:—

Mine Work.—The following development work has been carried out at the 192ft. level:—

No. 7 rise has advanced from 48ft. to 71ft., and a connection made with stopes. Average width of reef 30in., value 68s. per ton.

An intermediate drive from the south stopes has been put out 40ft., connecting with No. 7 rise. Reef exposed contains an average value of 70s. over a width of 28in.

292ft. Level.—The south drive on footwall lode extended 67ft. Total, 309ft. The reef followed showed a width of 36in. for the first 20ft., when it reduced to 14in.; average value 24s. per ton.

No. 2 rise, located 100ft. from main shaft, has gone up 54ft., and connected with the intermediate level. Reef at bottom of rise 15in. wide, improved to 50in. wide the last 10ft.; average value 51s. per ton.

Intermediate drive north extended from 35ft. to 149ft. Reef contains an average value of 49s.; width, 34in.

Stoping north from No. 1 rise has been carried on for a length of 65ft.

Plant.—An air compressor and receiver have been erected on the mine, and rock drills installed underground. This plant is working satisfactorily.

From the *Hidden Secret Gold Mine*, near Birdwood, hundred Talunga, 35 tons of stone treated at the Mount Torrens Government plant yielded 276ozs. 1dwt. 5grs. gold bullion, valued at £1,067 18s. 9d. The total amount of ore dealt with so far from this little mine is 74 tons 4cwts. for 401ozs. 5dwts. 5grs., worth £1,550 18s. 6d., or 418s. per ton.

The *Dustholes Mine*, near Mount Grainger (recently called *The Myrtle*) is now held by Mr. J. Nicholson, who has started prospecting work and also boring for water. This property has been worked intermittently for some time back, and records show that a total of 282 tons 7cwts. 1qr. of ore treated at the Peterborough Government plant yielded 109ozs. 6dwts. 23grs. of gold bullion, valued at £387 14s. 5d., or 27s. per ton.

Under tribute agreement some general prospecting has been done on the *Medora* and *Mount Grainger*, but no stone has been treated.

The revival in gold mining at *Wadnaminga* has, it is hoped only for the present, flickered out, and both batteries at the place are idle.

Tarcoola Blocks G.M.—98½ tons of stone from this mine gave 89¾ozs. gold bullion on treatment at the Tarcoola Government plant. Work has been confined to sinking an underlie shaft on the new West Reef, lease 1003, and prospecting several outcropping reefs on various parts of the property. The total quantity of stone treated from the West Reef is 185 tons for gold bullion valued at £538, or 58s. per ton.

At the *Lady Alice Mine*, Barossa, returns show 80 tons of stone raised, but nothing has been treated yet.

Returns from the two silver-lead mines working in the southern district show—

Mount Malvern.—3,550 tons raised, 307½ tons concentrates. Silver, 16ozs. per ton; lead, 55 per cent. Raising ore from stopes between 200ft. and 300ft. levels; sinking main shaft 100ft. to 400ft. level. Putting in pumps, purchasing additional plant.

Olivaster.—About 150 tons raised, 23 tons concentrates, 76.3 per cent lead, and 14.3ozs. silver per ton. Sinking new shaft 25ft.; driving new adit level 70ft.; raising, crosscutting, and stoping.

The bountiful rains of 1917 have considerably reduced the salt scraping harvest and the output of gypsum. The big rains will, however, probably have an ultimately beneficial effect on the salt lakes.

The Leigh Creek Coal Mine was worked on a small scale throughout the half-year for the purpose of raising sufficient coal to make exhaustive tests of its quality and value. All the operations at the mine were placed in the capable hands of the Inspector of Mines (Mr. Henry Jones), and were carried to a successful termination by him without a mishap of any description. It was found necessary to effect a number of repairs before the work of winning the coal could be rendered safe. The timber of the head gear and some of the shaft timbers had to be replaced. The level of the water in the mine had to be lowered by baling with tanks, and hauling machinery had to be installed before the mine became once more productive. A winch and vertical boiler were brought from the Nuccaleena Mine, near Beltana, and placed in position. Water for domestic purposes and for raising steam was brought by rail from Leigh Creek.

When work was discontinued in December the mine was left in thorough order, and work can be begun again without delay if occasion demands. A total quantity of 713 tons was raised from the workings, which are described in the later pages of this Review.

The Committee appointed to inquire into the commercial availability and economic utilization of this coal has already gathered together a mass of valuable information, and is continuing its investigations.

Arsenic.—The increased demand for arsenical ores, and the greatly enhanced prices now paid for arsenical compounds, have caused many inquiries to be made at the Department of Mines for possible South Australian sources of this metal. During the last six months arsenical pyrites has been worked at the Talisker Mine, near Cape Jervis, and in the neighborhood of Woodside. The Preamimma Mine, near Callington, formerly a productive source of arsenic, has recently changed hands, and it is hoped that it will soon re-enter the stage of active production. Other localities in South Australia at which arsenical pyrites has been noted are the Westward Ho! Mine, near Mannahill (*vide* Record of Mines, pp. 244 and 247), and

Section 96, hundred of Haines, Kangaroo Island. Auriferous scorodite has been found near Keyneton, probably overlying a deposit of arsenical pyrites. Traces of arsenides and arsenates of cobalt and nickel have been found in the North-East near Bimbowrie, and at the following places in the Flinder's Range, namely, Nichol's Nob, Mount Ogilvie, and near the Blinman Mine.

The phosphate rock deposits of the State are receiving a greatly increased amount of attention, largely on account of the difficulty of importing this material from the Oceanic Islands. This greater measure of reliance on the domestic sources of supply was anticipated, and the Assistant Government Geologist has been for some time engaged on an investigation of all the South Australian occurrences. Many of the deposits were examined at the time of their discovery by Mr. H. Y. L. Brown, but a great deal of development work has been done since then. The total output of rock phosphate to the end of 1917 from all South Australian sources, not including the guano shipped from the islands off the coast, is 81,483 tons, valued at £85,322.

There is every probability of an increased output during the coming year, and, as far as can be foreseen, for several years to come.

Graphite.—A full report on the appearance and prospects of the graphite-bearing localities of Eyre's Peninsula, based on a third visit of inspection by the Assistant Government Geologist (Mr. R. Lockhart Jack), appears in the later pages of this Review. It is gratifying to note that the prospects of this branch of the industry are bright, and that graphitic zones of payable width and grade are being developed. The work already done has actually proved that flake graphite containing 80 per cent. and over of carbon can be recovered from the crude graphitic schist. Concentration tests performed in the Departmental Laboratory have shown that it is possible to make a product containing, in one case, as much as 90 per cent. of carbon, and representing 12 per cent. of the bulk of the crude ore. This particular sample of concentrates was valued at approximately £40 per ton in London. Local values for export are estimated at about £10 less per ton, and if the grade drops to 80 per cent. of carbon, the London value is about £30 per ton.

The recent work has fully confirmed the previously expressed opinion that the district was well worth prospecting. A second body of graphitic schist, apparently of higher grade than any yet tested, is now being opened up in the hundred of Uley, within the area shown in the plan on page 59.

The amount of work hitherto carried out is, on the whole, quite incommensurate with the size and promise of the deposits, and the bands of high-grade material do not form such prominent outcrops as those of lower grade. It is more than probable that further prospecting by means of crosscuts at a depth of about 50ft. from the surface will reveal other bands of workable grade in the zones of graphitic schist.

The area that has been proved to be graphite-bearing is in a portion of the State which is readily accessible, and which possesses the advantages of good climatic conditions.

The Experimental Metallurgical Laboratory.—During the half-year the Government Metallurgist (Mr. J. D. Connor, B.Sc.) has been engaged on a number of different investigations at the Experimental Laboratory.

He carried out a series of tests of the oxidised copper ore won from the Yudnamutana field, with the object of testing the amenability of the ore to sulphuric acid leaching, followed by electrolytic precipitation. Satisfactory results were obtained.

The services of the same officer were granted, in the capacity of consulting metallurgist, to the owner of the Burra Mine, the tailings from which were undergoing treatment by leaching.

Ore from the Billy Springs Mine, at the northern extremity of the Flinder's Range, was tested with the object of ascertaining whether marketable products could be obtained by gravity concentration. In this case the admixture of minerals was such that it was found impossible to obtain a satisfactory recovery of the metal value present in the ore.

A parcel of tailings from the Mountain of Light Mine at Leigh Creek was submitted for examination, and was found to be rather expensive to treat on account of the consumption of acid and the lack of permeability by the leaching solution. These factors, and the small tonnage available, made the successful leaching of the ore impracticable.

A sample of auriferous arsenic ore from Keyneton was tested, with a view to designing a method of treatment. The gold content, however, proved low—4½dwts. per ton—and the arsenic was almost wholly in the form of scorodite (hydrous arsenate of iron). The intrinsic value of such ore is not sufficient to permit of its profitable treatment.

An elaborate series of concentration tests of the pyritic quartzite of the Gibraltar Mine, near Nairne, was made. A summary of these results will be found on page 26 of this Review in connection with the diamond drilling operations carried out by the Department.

A great number of determinations of the graphite contents of samples of ore from developmental workings on Eyre's Peninsula were made for the guidance of those who are prospecting in this promising field.

Legislation Controlling the Exploration for Potash in South Australia and in the United States of America.—The Director of Mines has furnished the following notes dealing with legislation controlling the development of certain types of deposits which are now being examined with the object of satisfying demands formerly filled to a large degree by Germany, namely, the deposits of natural salt or brine in the basins of internal drainage. There are, of course, many other possible sources of potash which are not concerned with the legislation designed to control prospecting or mining operations in the lake basins of arid regions; and these notes do not, therefore, have reference to other sources of potash than those of the saline lakes.

In Review No. 21 of Mining Operations, pages 9-10, the writer furnished some notes as to the possible sources of potash from South Australian mineral deposits, and suggested certain lake basins as fields for prospecting. Some prospecting work has since been carried out, and it has been found that the salt obtained from a number of the dry lakes contains a small proportion of potassium chloride (0.13 per cent. to 0.65 per cent.). A series of evaporation tests have been made with brine obtained in the southern part of Lake Gairdner.

In view of the attention that is being paid to the recovery of potash from saline lakes in the western part of the United States, it will be of interest to examine the terms and conditions on which the potash-bearing areas are leased in that country. The legislation in the United States of America, enacted to deal with saline deposits, has been passed by the Federal Congress and by the individual States to deal respectively with the disposal of:—

1. Lands which have been retained by the Government; and
2. Those lands which have been conveyed to the States.

Some differences in respect of the conditions of tenure under Federal and State legislation are noticeable, and the Federal legislation, which dates from September 21st, 1917, embodies some provisions which have been deemed advisable in the light of the most recent developments.

The Federal American Act, authorizing exploration for potassium on the Public Lands of the United States, provides for the granting of a "prospecting permit," giving the exclusive right, for a period not exceeding two years, to prospect for salts of potassium within areas not exceeding four square miles. The permit carries with it a preferential right to an area not exceeding one square mile in fee simple. The remainder of the land embraced in the permit, after the discoverer has exercised his right, may be leased in areas not exceeding four square miles, under specified terms and conditions. The royalty payable by the lessee must not be less than 2 per cent. of the gross value of the output at the point of shipment. The rental on the leases must not be less than 25 cents per acre for the first year, not less than 50 cents for the second, third, fourth, and fifth years, and not less than 1 dollar per acre for every succeeding year. The rental for any year is credited against royalty for that year. No term is fixed for the leases, but authority is given for the readjustment of terms and conditions at the end of each 20-year period following the issue of the lease.

The same act contains provisions designed to prevent monopoly and interlocking interests, by rendering it illegal for lessees to hold:—

1. Any interests in any leases exceeding in the aggregate 4 square miles in any area 50 miles square; and
2. More than one-tenth interest, direct or indirect, in any other agency engaged in the sale or resale of the products obtained from such leases.

Among other provisions of this Act, the right is reserved to the President of regulating the prices of all minerals extracted or sold, the prices to be fixed being such as to yield a fair and reasonable return to the lessee upon his investment, and to secure to the consumer any of such products at the lowest reasonable and consistent price. It is also provided that the President may so regulate the disposal of the potassium products as to secure their distribution and use wholly within the limits of the United States or its possessions.

The State of California, on April 27th, 1911, passed an Act withdrawing from sale the State Lands within the meander lines of lakes and streams, the waters of which contain minerals in commercial quantities, prescribing conditions for recovering these minerals, and providing for the leasing of the lands uncovered by the recession of the waters. The annual rental for lands thus leased is 2 dollars 50 cents per acre, and a royalty is stipulated amounting to 25 cents per ton of two thousand pounds of the minerals recovered and sold, and 50 cents per short ton of sodium bicarbonate and sodium

hydrate. No lease may run for more than 25 years, but provision is made for renewal on terms and conditions that may be prescribed by law at the time of the expiration of the lease.

In South Australia the existing legislation having a bearing on the exploration of possible potash-bearing lands is summarized in the following statement:—Search licences are issued under the Mining Act Amendment Act, 1900, and confer on the holder the right of searching specific mineral lands not exceeding 5 square miles in area for—

(*a*) Precious stones.
(*b*) Mineral phosphates.
(*c*) Oil.
(*d*) Rare metals, minerals, and earths which have not previously been worked at a profit within the State.

The rental is 20s. per square mile, and no person is permitted to hold, directly or indirectly, more than 5 square miles. Any discovery in payable quantities of the mineral substances sought must be reported at once. The search licence carries a preferential right (in the case of a licence to search for precious stones, metals, minerals, or earths) to a mineral lease not exceeding 40 acres.

Since, however, any potash that may be recovered from saline deposits in South Australia will, in all probability, be extracted from brine, or from encrustations of salt, the proper title under which these lakes should be worked is that of the miscellaneous lease, issued under the authority of the Mining Act, 1893, sections 63 and 64. The conditions specified in connection with miscellaneous leasehold for the working of salt deposits occurring on Crown Lands are as follows:—

No individual lease can exceed 1 square mile in extent, but any number of leases may be held. The minimum annual rental is 1s. per acre, and a royalty of 6d. in the pound on the net profits must be paid. The leases may be granted for a term not exceeding 42 years. Special labor covenants must be observed, a minimum of one man for every 40 acres during January, February, March, and April being specified, save when the area concerned is not in a fit state for gathering the salt.

From this statement it will be seen that ample and generous provisions have been made by existing South Australian legislation for the protection of the interests of those who are engaged in prospecting for potash deposits (under search licence), and for mining and working any payable deposit that may be found (under miscellaneous lease) on Crown Lands.

Reference to the foregoing paragraphs shows that the Federal legislation in the United States of America has provided for total alienation of the mineral rights over an area not exceeding 1 square mile. While such a provision is consonant with the general principles and past practice of mining legislation in the United States, it is absolutely opposed to the fundamental principles of all Australian legislation, which now provides, in all the States of the Commonwealth, for leasehold tenure from the Crown, to which minerals are reserved. It is noteworthy that the recent Federal Act passed by Congress in the United States gives authority for the leasing of the balance of the area embraced in a "prospecting permit" after the discoverer has exercised his preferential right. This feature seems to indicate a change of policy towards the establishment of a system of leasehold tenure of the minerals occurring within the Public Lands of the United States.

The "prospecting permit" of the United States corresponds in many respects to the search licence of South Australia, as may be seen from the following table:—

	United States Prospecting Permit.	South Australian Search Licence.
Maximum Area	4 sq. miles	5 sq. miles
Maximum Term	2 years	1 year
Rental	Not prescribed by Act	£1 per annum
Labor Covenant	Not prescribed by Act	1 man per square mile
Preferential Right	1 sq. mile in fee simple	40 acres mineral lease

The terms and conditions under which leases for mining saline deposits are granted over the Public Lands in the United States, the State Lands of California, and the Crown Lands of South Australia are set forth in the following table:—

	Public Lands, United States of America.	State Lands, California.	Crown Lands, South Australia.
Maximum Area	4 sq. miles	Not prescribed by Act	1 sq. mile. Any number of leases may be held
Maximum Term	20 years.	25 years	42 years
Minimum Rental	25 cents, rising to 1 dollar per acre in 6 years	2 dollars 50 cents per acre	1 shilling per acre
Royalty	2% of gross value of output	25 to 60 cents per short ton	2½% of net profits
Labor Covenant	Not prescribed by Act	Not prescribed by Act	1 man for each 40 acres during 4 months of year

DEPARTMENT OF MINES.

"THE NATIVE INDUSTRIES ENCOURAGEMENT ACT, 1872."

NOTICE OF THE OFFER OF A BONUS FOR THE DISCOVERY OF OIL

Adelaide, August 23rd, 1917.

A bonus of £5,000 is offered to the person or body corporate which first obtains from a bore or well situated in the State of South Australia 100,000galls. of crude petroleum, containing not less than 90 per cent. of products obtainable by distillation.

No application for a bonus will be considered unless the following conditions have been strictly complied with :—

1. The applicant for the bonus must have furnished to the Minister of Mines, during the progress of drilling operations—

(*a*) A monthly record of work done ;

(*b*) A full log of all bores and wells sunk, whether successful or unsuccessful ;

(*c*) Samples of materials passed through by the bores, to be taken at every 50ft. sunk, and also at every change of country encountered ;

(*d*) A declaration pursuant to "The Statutory Declarations Act, 1835," of the exact locality of each bore or well. (This should be furnished with the first monthly report on the bore or well.)

2. The oil must have been stored at the bore or well from which it has been obtained until the whole 100,000galls. has accumulated.

3. The applicant must furnish with his application—

(*a*) The certificate of a licensed surveyor nominated by the Minister of Mines as to the quantity of oil so stored ;

(*b*) The certificate of the Government Analyst of the result of his analysis of samples of the oil taken by a person nominated by the Minister of Mines ;

(*c*) A declaration pursuant to "The Statutory Declarations Act, 1835," that the whole of the oil for which the bonus is claimed was obtained from the bore or well where it is stored.

4. Within 24 hours of the first discovery of oil in the well or bore, notice of such discovery must be sent to the Minister of Mines.

5. Any person who desires at any time to inspect or test the well or bore on behalf of the Minister of Mines must be granted every facility for this purpose.

6. The applicant must have done nothing contrary to the provisions of "The Mining Act, 1893," or "The Mining Act Amendment Act, 1900," or of any lease or licence granted to the applicant under either of these Acts.

JOHN G. BICE, Minister of Mines.

DEPARTMENT OF MINES.

"THE NATIVE INDUSTRIES ENCOURAGEMENT ACT, 1872."

NOTICE OF THE OFFER OF A BONUS FOR THE PRODUCTION OF GRAPHITE.

Office of the Minister for Mines, Adelaide, August 23rd, 1917.

It is hereby notified that, pursuant to the powers conferred by the Act No. 30 of 1872, and of all other powers in that behalf, a bonus will be paid by the Government, on the conditions hereinafter stated, to persons who actually recover and sell graphite in the market. The bonus and the conditions will be as follows:—

1. A bonus of one pound (£1) per ton on marketable graphite will be paid to any person or body corporate producing such graphite from a mine in South Australia.

2. Such bonus will be paid on the production, to the approval of the Minister of Mines, of account sales of graphite sold prior to the 30th day of June, 1919.

3. Every applicant for the payment of a bonus shall lodge with the said Minister a declaration, made pursuant to the Statutory Declarations Act, 1915, that the whole of the graphite for which such bonus is claimed was produced in South Australia, and stating the exact locality where the same was obtained.

JOHN G. BICE, Minister of Mines.

CRUSHING AND CYANIDING PLANTS.

RETURNS FROM GOVERNMENT CRUSHING AND CYANIDING PLANTS FOR THE HALF-YEAR ENDED DECEMBER 31st, 1917.

Name of Mine.	Locality.	Weight of Ore.	Gold Bullion Recovered.	Total Value of Bullion.	Yield per Ton, in Shillings.
		Tons cwts. qrs.	Ozs. dwts. grs.	£ s. d.	s.
PETERBOROUGH BATTERY AND CYANIDE WORKS.					
Welsh Prince	Wadnaminga	10 0 0	3 10 13	12 8 0	24
Homeward Bound ..	Mannahill.....	7 15 0	8 19 4	35 5 5	91
" ..	"	9 15 0	12 18 11	50 14 4	104
" ..	"	3 16 0	3 3 12	12 11 7	66
" ..	"	11 0 0	9 12 4	37 12 1	68
Total.....		42 6 0	38 3 20	148 11 5	70
Grand total since starting of battery ..		5,237 16 0	4,736 1 20	17,600 0 9	67
TARCOOLA BATTERY AND CYANIDE WORKS.					
Royal George	Tarcoola	30 0 0	6 19 6	23 11 8	16
Tarcoola Blocks	"	25 12 0	18 16 17	68 13 3	53
Warrigal South	"	8 5 0	16 14 23	51 18 7	125
Royal George	"	26 16 0	4 10 8	14 9 1	10
Tarcoola Blocks	"	36 19 0	34 8 4	125 7 5	67
Tarcoola Perseverance	"	41 0 0	46 19 6	175 6 6	85
Day Dawn	"	31 0 0	7 19 0	23 17 0	15
Warrigal South	"	10 0 0	10 17 9	34 10 2	69
Curdnatta	"	7 0 0	5 13 0	17 13 5	50
Wondergraph	"	7 15 0	8 4 23	27 14 10	71
Warrigal South	"	14 0 0	15 0 14	49 12 4	70
Royal George	"	25 0 0	7 19 16	29 3 5	23
Tarcoola Blocks	"	36 2 0	22 10 0	67 14 1	37
Sands re-treatment ..	"	—	19 8 12	77 14 0	—
Total.....		299 9 0	226 1 18	787 5 10	47
Grand total since starting of battery ..		8,330 5 3	11,023 2 20	38,871 3 0	92
MOUNT TORRENS BATTERY AND CYANIDE WORKS.					
Haklo	Birdwood	8 0 0	3 17 16	13 3 5	33
Hidden Secret	"	20 10 0	218 13 9	841 15 9	821
Federal	Woodside	9 15 0	5 4 21	20 0 4	41
Hidden Secret	Birdwood	14 10 0	57 7 20	226 0 3	311
Total		52 15 0	285 3 18	1,100 19 9	417
Grand total since starting of battery ..		11,198 18 3	6,748 5 22	25,394 6 10	45

RETURNS FROM GOVERNMENT CRUSHING AND CYANIDING PLANTS—*continued.*

Name of Mine.	Locality.	Weight of Ore.	Gold Bullion Recovered.	Total Value of Bullion.	Yield per Ton, in Shillings.
		Tons cwts. qrs.	Ozs. dwts. grs	£ s. d.	s.
GLENLOTH BATTERY AND CYANIDE WORKS.					
Grand total since starting of battery ..		3,272 19 0	2,484 1 1	8,341 14 1	51

RETURNS FROM CRUSHING AND CYANIDING PLANTS (OTHER THAN GOVERNMENT) FOR THE HALF-YEAR ENDED DECEMBER 31ST, 1917.

Name.	Ore Treated.	Gold Bullion Recovered.	Value.	Yield per Ton, in Shillings.
	Tons cwts. qrs.	Ozs. dwts. grs.	£ s. d.	s.
DELORAINE GOLD MINE.				
Deloraine	2,561 0 0	1,879 0 0	6,949 16 8	—
*Total	2,561 0 0	1,879 0 0	6,949 16 8	54

* Also 17 cwt. copper, worth £106

KITTICOOLA, REEDY CREEK.			
Battery treatment	341 0 0	99 1 0	307 16 7	—
Total	341 0 0	99 1 0	307 16 7	18

TOTAL BATTERY AND CYANIDE RETURNS FROM ALL PLANTS FOR SIX MONTHS ENDED DECEMBER 31ST, 1917.

Name.	Ore Treated.	Gold Bullion Recovered.	Value.	Yield per Ton, in Shillings.
	Tons. cwts. qrs.	Ozs. dwts. grs.	£ s. d.	s.
Peterborough	42 6 0	38 3 20	148 11 5	70
Tarcoola	299 9 0	226 1 18	787 5 10	47
Mount Torrens	52 15 0	285 3 18	1,000 19 9	417
Deloraine	2,561 0 0	1,879 0 0	6,949 16 8	54
Kitticoola	341 0 0	99 1 0	307 16 7	18
Total	3,296 10 0	2,527 10 8	9,294 10 3	56

SUMMARY SHOWING TOTAL ORE TREATED AT STATE BATTERIES AND CYANIDE WORKS TO DECEMBER 31ST, 1917, FROM MINES HEREUNDER.

Name of Mine.	Locality.	Weight of Ore.			Gold Bullion Recovered.			Total Value of Bullion.			Yield per Ton, in Shillings.
		Tons.	cwts.	qrs.	Ozs.	dwts.	grs.	£	s.	d.	s.
Associated	Tarcoola	50	13	0	43	6	5	152	18	3	60
Ajax	Waukaringa	125	10	0	89	3	7	347	19	9	55
Angepena Treasure	Mount Serle	4	7	0	17	10	3	69	7	5	318
Block 245	Wadnaminga	4	16	0	9	16	10	33	18	8	141
Block 249	Wadnaminga	4	13	0	4	15	12	17	8	10	74
Bohun	Tarcoola	93	15	0	27	16	23	99	14	0	21
Barossa Cement	Barossa	98	10	0	28	9	3	114	16	6	23
Banksia	Woodside	219	17	2	180	13	7	698	11	6	63
Blumberg	Birdwood	699	12	0	600	7	22	2,257	8	4	64
Blumberg Proprietary	Birdwood	481	2	0	213	6	4	769	17	4	32
Brind	Woodside	127	16	3	44	18	4	153	0	8	23
Bird-in-Hand	Woodside	154	11	0	48	6	2	248	5	2	32
Boomerang	Outalpa	80	15	0	69	12	16	227	19	6	56
Blunsdens	Peterborough	39	19	0	3	0	19	9	14	0	4
Brilliant	Macaw Creek	9	2	0	8	15	8	29	5	10	64
Crane's Reef	Birdwood	120	12	0	41	2	10	152	7	11	25
Curdnatta	Tarcoola	777	1	0	943	3	6	3,472	4	6	89
Cobra	Birdwood	7	3	0	1	15	4	5	6	0	14
Crown	Birdwood	264	1	3	130	7	22	466	8	0	35
Copperlinka	Olary	165	3	0	111	3	0	419	3	6	50
Day Dawn	Tarcoola	983	13	0	1,546	14	19	5,172	13	7	105
Dark Hill	Near Tarcoola	25	10	0	6	3	17	20	15	9	16
Duchess Neindorf	Tweedvale	52	4	0	54	5	4	198	0	8	75
Deloraine	Kersbrook	482	12	2	569	16	23	2,116	18	8	87
Dart's Syndicate	Mt. Torrens	64	14	0	19	0	0	74	0	0	22
Durdan	Birdwood	217	16	2	83	16	12	316	10	4	29
Diamond Jubilee	Silverton, N.S.W.	12	6	0	4	7	7	13	5	10	21
Dustholes	*Vide* Myrtle	—			—			—			—
Esmonde	Wadnaminga	30	10	0	34	1	11	126	10	1	83
Eureka	Woodside	708	0	3	448	10	2	1,446	11	8	40
Evening Star	Tarcoola	11	2	2	14	5	23	42	19	0	77
Eclipse	Tarcoola	42	4	0	35	8	16	124	10	10	59
Eudunda Hope	Mannahill	32	15	0	7	18	13	30	13	4	18
Federal	Tarcoola	44	3	0	2	6	0	7	1	4	3
Federal	Woodside	41	1	0	20	16	11	81	18	6	39
Flagstaff	Birdwood	10	2	0	3	16	9	14	2	8	28
Fabian's Glenloth	Glenloth	18	10	0	18	18	13	72	17	7	78
Fabian's No. 2	Glenloth	31	13	0	14	5	4	45	12	8	28
Fabian's No. 3	Glenloth	901	10	0	1,179	4	15	3,955	4	0	87
Great Eastern	Wadnaminga	21	16	0	31	10	21	109	15	5	100
Gallipoli	Tarcoola	140	1	0	191	17	4	656	7	2	93
Government Mine	Tarcoola	445	6	0	1,024	16	22	3,386	1	1	152
Great Talunga (Black Snake)	Birdwood	369	4	3	225	7	15	834	0	1	45
Golden Gate	Angaston	159	4	0	283	9	8	1,185	15	8	149
Gowland's Reef	Mt. Torrens	101	8	3	29	11	4	106	7	3	21
Golden Thorpe	Woodside	187	2	0	81	12	7	322	11	5	34
Golden Junction	Mt. Grainger	222	15	0	149	13	12	570	18	4	51
Glen Markie	Glenloth	369	10	0	202	6	4	712	3	4	38
Great Glenloth	Glenloth	26	10	0	5	19	11	22	16	11	17
Glenloth Pioneer	Glenloth	37	19	2	29	5	9	106	18	8	56
Golden Stream	North-east	10	17	0	6	4	14	21	17	10	40
Glenloth Well	Glenloth	26	0	0	23	11	16	83	19	10	64
Golden Record	Wadnaminga	24	15	0	33	16	17	122	4	9	98
Hennig's	Parnaroo	98	12	0	22	11	10	78	0	3	15
Hall's Reef	Forest Range	34	0	0	37	11	6	138	3	7	81
Haklo	Birdwood	291	12	0	180	3	1	709	8	11	48
Homeward Bound	Mannahill	640	11	0	1,053	8	1	4,145	2	1	129
Hidden Secret	Birdwood	74	4	0	401	5	5	1,550	18	6	418

SUMMARY SHOWING TOTAL ORE TREATED, ETC.—*continued.*

Name of Mine.	Locality.	Weight of Ore.			Gold Bullion Recovered.			Total Value of Bullion.			Yield per Ton, in Shillings.
		Tons.	cwts.	qrs.	Ozs.	dwts.	grs.	£	s.	d.	s.
Ironclad	Mt. Grainger	12	6	0	11	18	9	44	9	5	72
Klondyke	Mannahill	36	11	0	82	0	10	321	3	8	175
Kitticoola	Palmer	14	15	0	18	17	8	69	5	11	94
Kirkcek's Treasure	Nillinghoo	485	0	0	780	11	9	2,845	15	0	117
King's Bluff	Olary	127	0	0	250	0	0	750	0	0	118
Lake Labyrinth	25 miles E. of Tarcoola	64	10	0	56	10	11	207	2	3	64
Last Resource	Tarcoola	152	15	0	108	9	20	384	1	9	50
Lease 938	Tarcoola	9	10	0	3	13	18	12	5	4	25
Lease 1022	Tarcoola	12	4	0	8	13	18	23	17	9	39
Lucky Hit	Birdwood	338	16	1	303	6	3	1,148	2	11	67
Little Crumb	Birdwood	77	11	2	136	14	7	516	5	7	133
Lux	Olary	265	8	0	156	4	21	550	17	0	41
Lady Alice	Barossa	24	1	0	49	15	22	195	13	4	162
Lone Hand	Glenloth	446	10	0	522	5	1	1,840	11	11	82
Lake View	Glenloth	18	7	0	25	3	10	88	6	2	96
Last Chance	North-east	11	0	0	2	18	11	11	3	3	20
Morning Star	Tarcoola	307	0	0	555	15	7	1,876	4	10	122
Menzies Barossa	Barossa	23	14	0	15	1	14	52	10	0	44
Mount Torrens	Mt. Torrens	1,252	11	0	652	10	16	2,483	18	5	39
Mount Grainger	Mt. Grainger	690	3	1	725	17	14	2,872	8	6	83
Myrtle (Dustholes)	Mt. Grainger	282	7	1	109	6	23	387	14	5	27
Mount Mitchell	Glenloth	28	9	0	7	6	6	23	5	5	16
Medora	Mt. Grainger	200	0	0	182	6	23	694	9	9	69
Miners Dream	Mt. Grainger	18	13	0	9	3	18	33	11	10	35
Mount Paratoo	Paratoo	50	0	0	5	0	16	15	7	0	6
Mount Lyndhurst	Lyndhurst	1	8	0	0	7	1	1	3	11	16
New Era	Woodside	794	18	0	455	6	13	1,756	6	2	44
New Eclipse or LeHunte	Woodside	189	5	0	141	13	23	529	16	9	56
New Milo	Wadnaminga	187	10	0	244	11	6	842	14	0	89
Nectar	Mannahill	18	14	0	28	10	23	109	2	2	116
Nil Desperandum	Glenloth	69	0	0	21	13	17	75	3	3	21
Nackra	Nackra	36	18	0	7	2	21	25	5	3	13
Outalpa	Outalpa	90	9	0	53	18	16	184	1	3	40
Perseverance (Gourlay's Claim)	Earea Dam	34	10	0	16	7	11	62	17	7	36
Proprietary	Tarcoola	6	0	0	3	8	8	10	13	6	35
Pioneer	Callington	97	2	0	31	8	20	120	16	9	24
Phoenix	Gawler	11	15	0	6	6	8	21	9	6	36
Royal Charlie	Mannahill	20	7	0	5	10	5	15	19	1	15
Royal George	3 miles west Tarcoola	927	17	0	539	19	0	1,975	8	6	42
Railway	West Australia	14	2	3	15	0	23	51	16	2	73
Royal Tiger	Glenloth	53	5	0	32	5	15	115	4	10	43
Ruby	Barossa	16	2	0	23	7	23	88	13	4	110
Reddaway's	Mt. Torrens	137	7	1	33	13	22	108	10	4	15
Scotchman	Teetulpa	14	17	0	9	18	20	34	4	8	46
Spanish American	Mannahill	21	3	2	10	12	11	39	6	3	37
Shamrock	Tarcoola	48	0	0	77	13	23	303	1	9	126
Schubert's Reef	Mt. Torrens	95	18	0	54	5	2	187	15	4	39
South Knappa	Woodside	7	13	0	3	7	11	13	2	6	34
Stars and Stripes	Mt. Grainger	20	3	0	5	18	10	22	17	7	22
Triumph	Wadnaminga	17	18	0	8	11	17	32	4	3	35
Tarcoola Blocks	Tarcoola	650	3	0	950	12	8	2,917	8	9	82
Tarcoola Blocks, Enterprise Lease	Tarcoola	402	11	1	484	10	20	1,661	19	5	89
Tarcoola United	Tarcoola	56	10	0	100	0	15	331	4	3	117
The Gem	Tarcoola	42	12	0	90	6	19	277	16	11	130
Tarcoola West	Tarcoola	53	5	0	63	14	4	253	5	11	95
Tarcoola Perseverance	Tarcoola	1,766	14	3	3,136	14	18	11,761	9	6	133

SUMMARY SHOWING TOTAL ORE TREATED, ETC.—*continued*

Name of Mine.	Locality.	Weight of Ore.			Gold Bullion Recovered.			Total Value of Bullion.			Yield per Ton, in Shillings.
		Tons.	cwts.	qrs.	Ozs	dwts	grs.	£	s.	d.	s.
Tolmer's Hill	Tarcoola	6	0	0	1	11	16	5	8	0	21
Union Jack	Waukaringa	17	2	0	2	16	13	9	18	9	11
Ulooloo	Ulooloo	28	5	0	13	5	11	52	19	0	37
Vienna (Descovitch's Reef)	Mt. Pleasant	23	13	0	12	10	1	42	11	10	36
Virginia	Wadnaminga	13	1	0	18	10	14	68	6	1	104
Warrigal South	Tarcoola	73	12	3	107	2	12	341	1	6	92
Wondergraph	Tarcoola	30	5	0	57	0	4	200	4	6	132
Warrigal	Tarcoola	118	17	0	134	16	4	347	18	5	58
Wilgena Syndicate	Tarcoola	29	15	0	23	15	12	88	10	7	59
Wilgena Enterprise	Earea Dam	348	8	0	323	7	22	1,279	8	2	73
Wilgena Associated	Tarcoola	45	0	0	98	10	10	364	3	11	161
Wheal Ellen	Strathalbyn	68	0	0	18	9	5	62	8	11	18
Welsh Prince	Wadnaminga	10	0	0	3	10	13	12	8	0	25

COPPER.

AVERAGE MONTHLY PRICE OF COPPER, JULY TO DECEMBER, 1917

	Standard.				Electrolytic.		
	£	s.	d.		£	s.	d.
July	128	13	2	..	138	8	2
August	122	10	5	..	135	0	0
September	117	15	0	..	133	5	0
October	110	5	0	..	123	0	0
November	110	5	0	..	123	0	0
December	110	5	0	..	123	0	0
Average for the six months	£116	12	3	..	£129	5	6

RANGE OF PRICES.

STANDARD COPPER.

Highest—July 14th	£131	5	0
Lowest—October 1st	£110	5	0

ELECTROLYTIC COPPER.

Highest—July 14th	£140	0	0
Lowest—October 3rd	£123	0	0

AVERAGE PRICE OF STANDARD COPPER FOR THE LAST TEN YEARS.

	£	s.	d.		£	s.	d.
1908	60	0	10	1913	68	5	8
1909	58	17	2	1914	60	8	1*
1910	57	3	3	1915	72	12	9
1911	56	1	10	1916	116	1	3
1912	73	1	3	1917	125	2	4

Average for the 10 years, £74 15s. 5d.

* Quotations for nine months only.

GOVERNMENT DIAMOND DRILLING OPERATIONS.

REPORT BY THE SUPERVISOR OF BORING OPERATIONS.

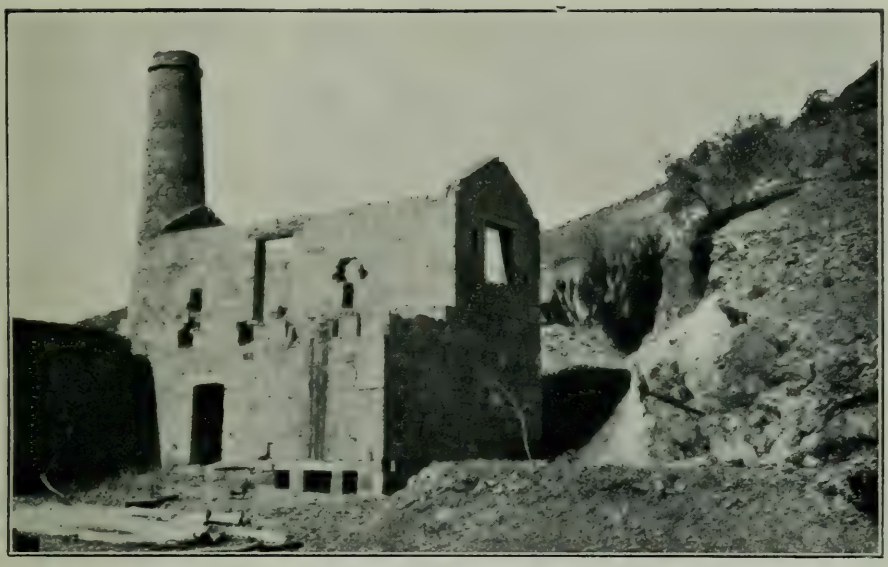
During the half-year ended December 31st, 1917, both the diamond drilling plants were continuously employed.

The No. 1 drill, in charge of Mr. A. W. Matthews, continued the work of probing for any possible shoot of ore beneath some very old workings to the south-east of the main shaft at the Wandilta Mine, near Kadina. The drill penetrated to a total depth of 703ft. without meeting with any compact body of ore. A veinlet, only 1in. in thickness, carrying copper pyrites, was cut at a depth of 580ft. from the surface, and traces of copper pyrites were seen between 668ft. and 670ft., and also between 685ft. and 695ft. These occurrences of disseminated chalcopyrite have been noted in several of the cores obtained from holes drilled in this property, but none of them have offered any promise of proving profitable on development. Moreover, the patches containing disseminated copper pyrites in the several boreholes do not occur in defined channels that can be traced from one borehole to another. Twelve boreholes in all have been drilled in this property, and it appears that all reasonable prospects of locating a payable shoot of ore have been taken into consideration in selecting the bore sites.

On the completion of the No. 12 bore at the Wandilta Mine the No. 1 drill was moved from Kadina to Moonta and was set up on the Yelta Mine. The lode now being explored by boring is that mapped as the "Eastern lode," and which has been exposed in the Eastern or Wild Dog workings in the southern part of the Yelta leases. On the boundary between the Yelta and Moonta Mines leases some very old workings exist, and the first of the new series of bores was drilled to test this lode, which appears to be situated on the belt of fracturing which embraces Elder's lode in the Moonta Mines. The No. 9 bore of the Yelta series was drilled to a total depth of 402ft. at a depressed angle of 60deg., and passed through the lode, proving 7in. of ore between 365ft. 2in. and 365ft. 9in. The core recovered proved on assay to contain 5.8 per cent. of copper and 1dwt. of gold per ton. The sludge obtained at this point contained 2.7 per cent. of copper and a trace of gold. Lode matter was penetrated between 365ft. 9in. and 367ft. 10in., and was found on assay to carry 0.4 per cent. of copper and a trace of gold per ton.

The drill was then moved to a fresh position to test the same lode between the boundary of the lease and the Eastern or "Wild Dog" Shaft. This borehole had reached a depth of 200ft. in the hanging wall country at the end of the period with which this report is concerned.

The No. 2 drill, in charge of Mr. C. F. Duffield, was engaged during the earlier part of the half-year in carrying out boring operations on the Gibraltar pyritic deposit described in Mining Review No. 26, pages 65-67. The principal object of this boring was to secure a complete sample across

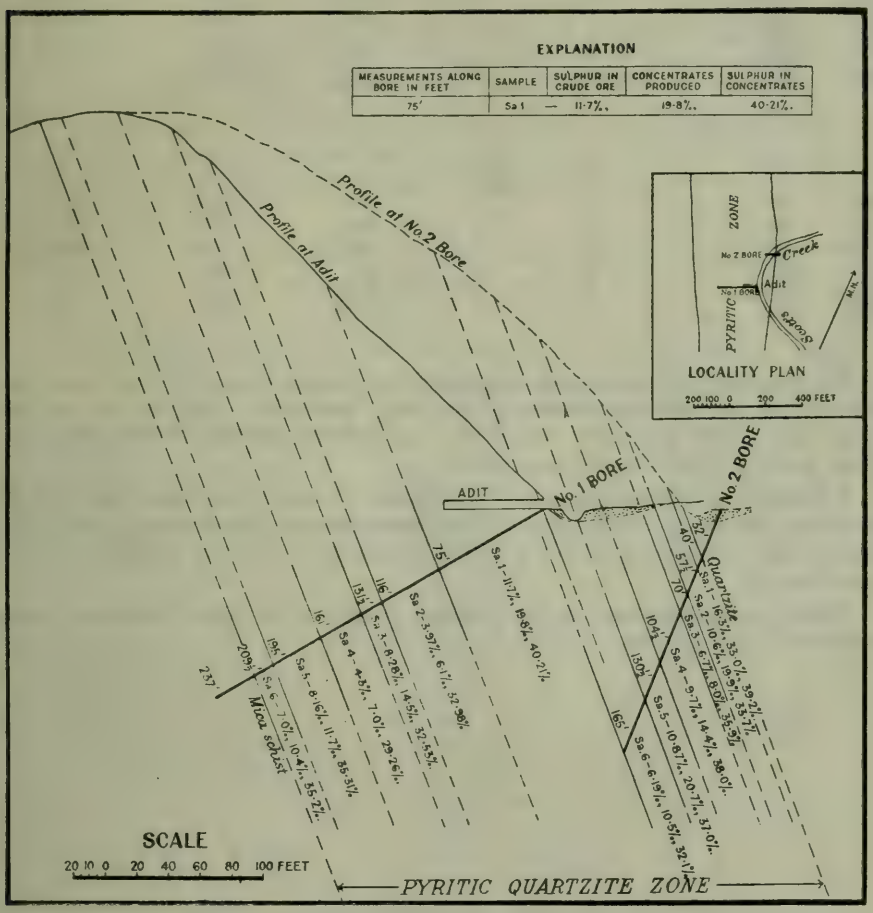


NUCCALEENA COPPER MINE. OPEN CUT IN SIDE OF HILL.

NUCCALEENA COPPER MINE, SHOWING MAIN SHAFT.

To face p. 24.]

the impregnated zone, for the purpose of carrying out concentration tests. The deposit proved, on drilling, to be fairly uniform in texture, and gave cores that were practically complete from each of the two holes drilled. The accompanying drawing shows the way in which the drill holes were laid out to sample the full width of the deposit. It will be seen that two holes were drilled and that there is a slight overlap in the central portion of the deposit.



GIBRALTAR PYRITIC DEPOSIT.

Section showing projection of bores on one plane with results of sampling and concentration tests.

The core recovered was divided up according to its appearance into samples of various lengths, the basis of subdivision being the degree of impregnation with pyrites. Thus it was sought to separate the pyritic zone into bands which might be individually worked. The core samples were tested by the Government Metallurgist in the experimental laboratory of

the Department of Mines, and the results obtained from each sample are shown briefly in the following table:—

Measurements along Bore in Feet.	Bore Number.	Sample.	Sulphur in Crude Ore.	Concentrates Produced.	Sulphur in Concentrates.
0 to 75	1	1	11·7	19·8	40·21
75 116	1	2	3·97	6·1	32·98
116 131·5	1	3	8·28	14·5	32·53
131·5 161	1	4	4·3	7·0	29·26
161 195	1	5	8·16	11·7	35·31
195 209·5	1	6	7·0	10·4	35·2
209·5 237	1	7	3·56	Not tested	—
0 to 32	2	Barren quartzite	—	—	—
32 40	2	1	16·3	33·0	39·2
40 57·5	2	2	10·6	19·9	33·7
57·5 70	2	3	6·7	8·0	35·9
70 104·5	2	4	9·7	14·4	38·0
104·5 130·5	2	5	10·87	20·7	37·0
130·5 165	2	6	6·19	10·5	32·1

The concentrates recovered consisted in round numbers of 50 per cent. iron pyrites, 30 per cent. pyrrhotite, 20 per cent. insoluble. Only a trace of gold (less than ½dwt. per ton) was found in the concentrates, which were free from lead, copper, arsenic, and silver.

A detailed investigation into the methods of concentration of this pyritic material has been carried out by the Government Metallurgist, and a full report has been prepared for publication when it becomes possible to print and issue it.

Owing to the shortage in the supplies of paper, no logs of bores are being printed in this Review.

SUBSIDIES.

The Legislature provided in the Mining Act, 1893, and in previous measures for the encouragement of mining.

The following schedule shows what subsidies have been paid from the inception of the system to December 31st, 1917, and the sums repaid. In the ordinary way these repayments are made from profits—50 per cent. of such profits being devoted to repayments In two instances only have the profits won enabled full repayments to be accomplished—the Crystal Mine, at Echunga, which repaid £76 7s.6d. from that source, and the once-famous New Alma and Victoria Mine, Waukaringa, which repaid in full the first subsidy, £3,000. The repayment of £2,100 by the Hamley Company was made on the sale of the property to the Wallaroo and Moonta Co. The remainder of the recoveries was derived from sales of mining plant held as security. The total of the subsidies advanced is £64,797 3s. 3d., of which £10,167 12s. 1d. has been recovered, and £1,500 written off, leaving a debit balance of £53,129 11s. 2d. Portion of this outstanding debt is represented by machinery that has fallen into the hands of the Government; add to this the value of the metals won, and the State in general will probably have benefited beyond the money value of the debit balance.

STATEMENT OF SUBSIDIES PAID FROM COMMENCEMENT TO DECEMBER 31ST, 1917.

Name of Company or Person to whom Subsidy Granted.	Locality.	Amount Advanced.	Amount Repaid.
		£ s. d.	£ s. d.
Adelaide Crushing, Grinding, and Amalgamating Mill Co.	—	100 0 0	—
Algebuckina Gold Mining Syndicate	Algebuckina	52 10 11	52 10 11
Alma Extended Gold Mining Co.	Waukaringa	3,000 0 0	172 5 0
Backhouse, T. S.	Worturpa	100 0 0	—
Barossa Enterprise Gold Mining Coy.	Barossa, Hundred of	232 2 6	—
Belalie Copper Mining Syndicate	Bundaleer	392 12 3	—
Beltana Rapid Ore Treatment Syndicate	Near Beltana	596 8 4	—
Bevilaqua & Angel	Palmer (near)	57 18 0	—
Bird-in-Hand Gold Mining Co.. Ltd.	Woodside	3,000 0 0	—
Blackfellow's Creek Gold Mining Co., Ltd.	Kuitpo, Hundred of	660 6 7	35 0 0
Callington Copper Mining Co.	Callington	148 8 7	15 0 0
Cockburn Copper Mining Co., N.L.	Mutooroo	273 18 5	173 13 8
Commonwealth Silver-lead Co., Ltd.	Strathalbyn, Hund. of	750 0 0	125 13 3
Copper Hill Mining Co., N.L.	Kadina	391 15 0	115 0 0
Cornwall Copper Mining Syndicate, N.L.	Kadina, Hundred of	500 0 0	—
Countess of Jersey Gold Mining Co., N.L.	Wadnaminga	321 0 0	—
Cowell Consolidated Silver and Copper Mines	Hds. Miltalie & Hawker	406 9 8	25 0 0
Currency Creek Copper Mining Co.	Currency Creek	28 6 5	20 0 3
Crystal Gold Mining Co.	Echunga	563 17 6	176 7 6
Davis, A. (Dorris Fabian Mine)	Leigh's Creek, Near	357 0 0	—
Ding Dong Copper Mining Syndicate	Kanmantoo, Hund. of	124 0 4	—
Duke of Cornwall Gold Mining Syndicate	Mount Pleasant	458 17 4	43 10 0
Eagle Silver Mining Co, Ltd.	Glen Osmond	500 0 0	—
Ediacara Consols Silver Mining Co., N.L.	Ediacara	651 12 1	465 17 0
Enterprise Copper Mining Co., N.L.	Barossa, Hundred of	150 0 0	9 16 0
Enterprise Excelsior (Barossa Amalgamated)	"	2,000 0 0	—
Eureka Gold Mining Co., Ltd.	Woodside	1,500 0 0	—
Eureka Gold Mining Syndicate	"	340 17 11	—
Fels, J. A. R. (Nichol's Nob Mine)	Leigh's Creek, Near	150 0 0	—
Fifth Creek Central Silver and Copper Mining Co., N.L.	Fifth Creek	253 2 4	—
Fortress Hill Mining Syndicate	Fortress Hill	60 0 0	—
Foster, A. E. J.	Hundred Onkaparinga.	19 5 0	—
Glenloth Mining, Battery, & Options Co., N.L.	Glenloth	515 4 7	515 4 7
Glenloth Wells Pioneer Blocks Co., Ltd.	"	100 0 0	22 18 5
Great Eastern Gold Syndicate, N.L.	Wadnaminga	300 0 0	—

STATEMENT OF SUBSIDIES PAID—*continued.*

Name of Company or Person to whom Subsidy Granted.	Locality.	Amount Advanced.			Amount Repaid.		
		£	s.	d.	£	s.	d.
Gumeracha Gold Mining Syndicate	Gumeracha	75	0	0	—		
Golden Junction Gold Mining Co, N.L.	Hundred of Coglin	210	10	0	—		
Golden Point Claims	Wonna	50	0	0	—		
Great Ironclad Gold Mining Co.	Teetulpa	218	6	9	—		
Hakendorf, C. H., and Williams, J. (Glenmarkie Mine)	Glenloth	221	17	6	—		
Hamley Copper Mining Co.	Wallaroo	2,100	0	0	2,100	0	0
Homeward Bound and Klondyke Gold Mines, N.L.	Mannahill	192	17	1	38	18	6
Heithersay, J. (Kirkeeks Treasure Mine)	Waukaringa	819	8	0	—		
Hunter Bros. (Lady Millicent Mine and Nuccaleena Mines)	Mochatoona	699	19	10	7	10	0
Ireby Gold Mining Syndicate	Mount Grainger	35	4	3	—		
Kanappa Copper Mining Co.	Hundred Angas	146	19	11	1	5	0
Kanmantoo Copper Mines Syndicate, N.L.	Kanmantoo	150	2	1	—		
Kingsborough, W. A. (Benowrie Mine)	Near Cutana	31	18	6	—		
Kirkeek's Treasure Gold Mining Co.	Waukaringa	691	8	1	—		
King's Bluff G.M. Co., N.L.	Olary	622	0	8	—		
Kohinoor Gold Mining Co., N.L.	Kangaroo Island	100	0	0	—		
Kohinoor Mine (H. G. Taylor)	"	200	0	0	—		
Lady Alice Gold Mining Co.	Barossa, Hundred of	1,797	2	3	—		
Lady Franklin Syndicate	Port Lincoln	200	0	0	40	0	0
Leigh's Creek South Coal Mining Co., N.L.	Leigh's Creek	95	16	4	95	16	4
McMurtie's Claims	Kuitpo, Hundred of	199	19	11	—		
Mingary Gold Mining Co.	New Luxemburg	400	0	0	—		
Montacute Gold and Copper Mining Co., N.L.	Sixth Creek	400	0	0	—		
Mount Victoria Mine	Bimbowrie	50	0	0	—		
Mount Malvern Silver Mining Co.	Blackwood	491	3	6	—		
Mount Malvern Silver-lead Mining Co., N.L.	Clarendon	1,539	6	4	—		
Mount Pangæus Gold Mining Co.	Hahndorf (near)	56	1	4	—		
Mount Monster Gold Mining Syndicate	Kuitpo, Hundred of	350	0	0	1	0	0
Mt. Grainger Ironclad Gold Mining Syn., Ltd.	Mount Grainger	21	18	10	—		
Mount Torrens Gold Mining Co.	Mount Torrens	1,000	0	0	—		
Mount Remarkable Mining Co., Ltd.	Wongyarra, Hund. of	122	8	1	15	0	0
Musgrave Ranges Prospecting Association	Musgrave Ranges	47	2	0	—		
Mount Painter Corundum and Gem Syndicate	Mount Painter	47	3	1	—		
Morning Star Gold Mining Co.	Teetulpa	68	4	6	—		
Mutooroo Copper and Silver Mining Co., Ltd.	Mutooroo	500	0	0	500	0	0
Myrtle Gold Mines, N.L. (Dustholes)	Hd. Coglin	370	1	4	—		
Nackara Proprietary Copper Mining Co., N.L.	Nackara	100	0	0	—		
Nackara Proprietary Gold Mining Syndicate.	Nackara	100	0	0	—		
New Banksia Gold Mining Syndicate	Nairne	250	0	0	—		
New Alma and Victoria Gold Mining Co., Ld.	Waukaringa	3,000	0	0	3,000	0	0
New Ajax Consolidated Gold Mining Co., N.L.	"	750	0	0	—		
New Era Gold Mining Co., Ltd.	Woodside	1,000	0	0	—		
New Glenloth Battery and Mining Co., N.L.	Glenloth	750	0	0	—		
New Medora and Grainger Gold Mines Syn., N.L.	Mount Grainger	1,421	9	9	—		
New Mingary Gold Mining Co.	New Luxemburg	250	0	0	—		
New Mount Grainger Gold Mines, N.L.	Mount Grainger	393	7	1	220	0	0
Northern Mining and Smelting Co., N.L.	Mount Rose	350	0	0	3	15	0
North Nairne Gold Mining Co.	Nairne	500	0	0	—		
North-West and West Australian Pros. Co.	North-west of S.A.	104	9	7	—		
North-West Prospecting Association, N.L.	Tarcoola	150	0	0	—		
Nil Desperandum Teetulpa Devt. Co., N.L.	Teetulpa	64	14	4	20	5	6
Nilpena Copper Mining Co., Ltd.	Blinman	290	5	3	—		
Olivaster Silver-Lead Mining Co., N.L.	Hundred Yankalilla	300	0	0	—		
Onkaparinga Dredging and Mining Co., and Echunga Propy. Hydraulic Gold Sluicing Co.	Biggs' Flat	1,050	0	0	700	0	0
Paull's Consolidated Copper Propy., N.L.	Burr Well	525	0	0	16	13	0
Parara Mining Co., N.L.	Maitland	571	3	6	—		
Paringa Mining Syndicate	Callington	399	16	8	244	0	0

STATEMENT OF SUBSIDIES PAID—*continued.*

Name of Company or Person to whom Subsidy Granted.	Locality.	Amount Advanced.			Amount Repaid.		
		£	s.	d.	£	s.	d.
Paringa and West Kanmantoo Consolidated Copper Mine, N.L.	Callington	1,144	3	4	210	5	0
Pioneer Gold and Copper Mining Syndicate	"	95	15	6	1	11	6
Polmear, W. J. L.	Kadina	800	0	0	—		
Poonana Silver, Lead, & Copper Mining Syn.	Hundred Mann	107	10	0	—		
Port Lincoln Copper Co., Ltd.	Reedy Creek	800	0	0	—		
Prince Albert Mining Syndicate	Hundred Onkaparinga.	214	0	0	—		
Queen Bee Mining Co., N.L.	New Luxemberg	250	0	0	250	0	0
Quorn Manganese and Silver Mining Co.	Quorn	10	9	10	—		
Rapid Bay Silver Mining Co., N.L.	Yankalilla, Hund. of	136	2	4	—		
Robertstown Bright Silver Lead Mines	Hd. Bright	170	5	11	—		
Royal Charlie Gold Mining Co.	Mannahill	153	18	5	—		
Rees, R., Ajax Mine	Waukaringa	604	14	5	—		
Saunders, L. E.	Wadnaminga	98	10	0	—		
Sixth Creek Gold & Copper Mining Co., L.N.	Sixth Creek	161	1	11	—		
Stainbank, A. T.	Fifth Creek	70	14	11	—		
Sliding Rock Copper Proprietary, N.L.	Sliding Rock	2,000	0	0	31	7	0
Tarcoola Blocks Gold Mining Co., Ltd.	Tarcoola	4,345	5	2	150	19	11
Tarcoola Enterprise Gold Mining Co., N.L.	"	100	0	0	19	10	4
Tarcoola Proprietary Gold Mines, N.L.	Tarcoola	150	4	4	9	15	0
Teatree Gully Gold Mining and Pros. Assn.	Teatree Gully	234	5	7	—		
Teetulpa Mining and Crushing Co.	Teetulpa	349	11	4	—		
Teetulpa Prospecting Syndicate	"	49	15	6	—		
Tumby Bay Copper Mining Co., N.L.	Hutchison, Hund. of	800	0	0	—		
Utica Copper Mining Co. N.L.	Burra	224	16	7	109	18	6
Victoria Hill Amalgamated Gold Mining Syn.	Barossa, Hundred of	38	12	6	—		
Victoria Tower Mining Co., N.L.	Mannahill	345	18	9	90	0	0
Warrakimbo Propy. Copper Mining Synd.	Barndioota, Hundred of	220	16	2	—		
Warra Warra Propy. Copper Mines, N.L.	Farina	322	4	11	322	4	11
Watt's Gully Gold Mining Co.	Gumeracha	50	0	0	—		
Watt's Gully Reef Claims	Gumeracha	50	0	0	—		
Wolters, F. C., & Co	Echunga	25	0	0	—		
Wallaroo Central Mining Co., N.L.	Kadina	500	0	0	—		
Westward Ho Mine (Dr. H. Dixon)	Mannahill	1,000	0	0	—		
Wohler, H., & Co.	Myponga	20	0	0	—		
Wheal Turner Copper Mining Co., Ltd.	Prospecting on proposed line to Queensl'd Border	1,000	0	0	—		
Winninninnie Gold & Silver Propy. Co., N.L.	Winninninnie	86	3	6	—		
Woodside Boring and Mining Syndicate	Woodside	422	17	11	—		
Worturpa Exploration and Mining Co., Ltd.	Worturpa	800	0	0	—		
Yelta New Copper Mining Co., N.L.	Wallaroo	1,000	0	0	—		
Young Bullfinch Gold Mining Co., N.L.	Talunga, Hundred of	146	3	4	—		
Totals	—	64,797	3	3	10,167	12	1

ACCIDENTS IN MINES AND QUARRIES.

A gratifying feature of our mining operations in mines and quarries is the infrequency of serious accidents. Act No. 858 of 1904, bringing quarries in the same category as mines as regards the control of the Department of Mines has been effective in safeguarding the interests of quarry-men. The following table gives the number of accidents in mines and quarries during the last ten years :—

ACCIDENTS IN MINES AND QUARRIES.

Accidents in Mines.				Accidents in Quarries.			
Year.	Total Number of Accidents Reported.	Number of Persons Injured.	Number of Persons Killed.	Year.	Total Number of Accidents Reported.	Number of Persons Injured.	Number of Persons Killed.
1907	10	4	6	1907	3	1	2
1908	5	4	1	1908	—	—	—
1909	6	5	1	1909	1	1	—
1910	6	3	3	1910	2	1	1
1911	2	—	2	1911	—	—	—
1912	3	2	1	1912	2	—	2
1913	10	8	2	1913	—	—	—
1914	3	2	1	1914	3	2	1
1915	3	—	3	1915	3	2	1
1916	5	1	4	1916	—	—	—
1917	8	6	2	1917	2	2	—

ASSAYS AT SCHOOL OF MINES.

NUMBER OF ASSAYS MADE FOR PUBLIC PURPOSES AT THE SCHOOL OF MINES ASSAY DEPARTMENT DURING THE SIX MONTHS ENDED DECEMBER 31st, 1917.

	1917.					
	July.	August.	September	October.	November	December.
Department of Mines	51	36	42	74	133	132
Public assays.....	93	60	41	53	57	36
Totals.....	144	96	83	127	190	168

Notes on the Sampling and Valuation of Prospects.

The Department of Mines, Flinders Street, Adelaide, frequently receives for assay and advice, parcels of various minerals and ores. Such a parcel may have one or more of the following faults:—

(1) It may contain a single piece, obviously picked.

(2) The quantity forwarded may be of insufficient size either for assay purposes or to properly represent the material sampled.

(3) The parcel may be unaccompanied by any statement or request showing the information desired.

(4) It may carry no marks to identify it with the letter of advice.

(5) There may be no letter of advice.

(6) There may be no declaration of the exact locality, without which free assays cannot be made.

(7) The letter of advice may contain no information as to the width or size of the body from which the material has been taken—information which may be necessary before it is possible to advise as to the value of a deposit.

THE MEANING OF THE WORD "SAMPLE."

A specimen is not a sample. A specimen shows the nature of a rock or ore; a sample is intended to show its value, and must be representative of a pile of ore or of a lode at a definite place.

A "representative" sample is a small proportion of the original bulk, containing, in unchanged percentages, all the constituents of the original lot. Such a sample gives the value of a pile of ore. The average of a number of samples, broken from the workings of a mine, represents very closely the value of the material sampled. Both broken ore and mines are, in many cases, sold on the values arrived at by sampling.

HOW TO TAKE A SAMPLE.

In sampling a lode, samples should be taken at definite intervals, and the lode should be sampled over measured widths at these localities. Widths should be measured at right angles to the lode, that is, along the shortest line between the walls.

A sample must be taken by breaking the same bulk for each foot of width. This should be done as evenly as possible over the whole width that the sample is intended to represent, and all the material that would be subsequently milled or smelted, whether rich or poor, should be included in the sample. The quantity taken might amount to one pound per foot of lode width; but the nature of the ore body and the distribution of the values (whether uniform or irregular) must be considered when deciding on the size of the sample. With uniform values the interval along the lode can be greater and the amount broken less than if the lode carries irregular values, as in the case of a lode carrying coarse gold.

THE PROPER WAY TO REDUCE THE SIZE OF A SAMPLE.

Such a sample, if of any considerable size, should then be broken into smaller pieces, well mixed, and quartered down. Quartering down means that the broken ore, after mixing, is piled into a cone on a floor or cloth, and that the cone is flattened and subdivided into four parts by two cuts at right angles. If the ore is sufficiently broken and mixed the sample obtained by taking the two opposite quarters, A A, has a value equal to the rejections B B, shown in the following diagram:—

HOW A SAMPLE SHOULD BE QUARTERED.

At each quartering care should be taken to sweep all rejections away.

By successive finer crushing and quartering, a sample, of 1lb. to 2lbs. is obtained that has the same value as the bulk first broken from the lode. This sample of 1lb. to 2lbs. should then be properly bagged, marked, and sent for assay. It would be well to enclose a specimen of 1oz. to 2ozs. of the uncrushed ore for inspection.

In reducing the large sample first obtained it is essential that the lumps of ore be broken smaller by at least half between each quartering. For example, a sample averaging, as broken, 1in. pieces, might be broken to $\frac{1}{2}$in., $\frac{1}{4}$in., and $\frac{1}{8}$in. particles before each successive quartering, to ensure uniform mixing and the even distribution of the valuable material.

THE USE OF ASSAY RESULTS.

Individual samples of standing ore may differ from the true value of the lode, but the average of a number of such samples will be very nearly that of the body of stone which they represent. Thus it will be seen that, in estimating the value of standing ore, reliance is to be placed, not on a single sample, but on the average value of a number of samples.

THE VALUATION OF BROKEN ORE.

Sampling a pile of broken ore may be done either by quartering, or by taking every second, tenth, or any other proportion of shovelfuls when shovelling the pile over, the proportion depending upon the way in which the values are distributed through the ore.

In sinking or driving on a lode, the value of the ore broken can be determined by making a separate pile with every fifth or tenth bucket of ore raised, and cutting down the small pile so made by shovelling and quartering. This procedure, if adopted, would in many cases prevent undue disappointment or the incurring of a loss through sending unpayable material to be treated.

ESTIMATION OF GOLD CONTENTS BY PANNING.

In estimating gold contents by panning during prospecting work, representative samples of constant weight or bulk should be taken. Too often a selected lump of kindly appearance is crushed, with the result that the value of the ore is over-estimated, and disappointment results when a parcel is sent to a battery. A record kept of all panning results, and the position and width of lode over which a sample is taken, will do much towards facilitating the opening up of a mineral property.

SUGGESTIONS FOR TAKING AND FORWARDING SAMPLES.

It is suggested that the following precautions be taken in sending samples for assay:—

(1) Each sample should be taken so as to be representative of the material sampled.

(2) Each sample should be properly marked so that it can be identified by the Department and by the sender.

(3) A letter of advice referring to these marks should be sent containing particulars as to—

- (*a*) The exact location of the material sampled relatively to some well-known point.
- (*b*) The width over which the sample has been taken.
- (*c*) The depth at which it was taken.
- (*d*) What valuable constituent is supposed to be present.

The Department reserves the right to refuse to make any particular assay of samples of insufficient promise or which do not conform to the conditions enumerated above.

No assays will be made of metallurgical products, and no umpire samples or materials showing free gold will be tested.

REPORTS FORMING ADDENDA TO THE RECORD OF MINES.

REPORT

BY

The Government Geologist (L. Keith Ward, B.A., B.E.)

AND

The Chief Inspector of Mines (L. J. Winton, B.E.).

REPORT ON THE LEIGH CREEK COAL FIELD.

The following account comprises a summary of the information available with regard to the occurrence of coal in the Leigh Creek field:—

The principal report dealing with this field is that which was written by Mr. H. Y. L. Brown, in September, 1891, and which was printed as Parliamentary Paper No. 158, 1891. Further information is contained in the Record of Mines of South Australia, pages 344-346, and in Review No. 14 of the Mining Operations in the State of South Australia, pages 15 and 16.

Geographical Position of the Field.—The coal-bearing strata occupy two basins which are traversed, in part, by the Great Northern Railway. The long axis of the field is approximately meridional, and there are two railway stations situated on the coal measures. The station of Copley (formerly Leigh Creek), is located within the southern coal basin, and is distant 373¼ miles by rail from Adelaide, and 163¼ miles by rail from Port Augusta. The station or siding of Telford is within the northern of the two basins, and close to the area prospected by shafts and bores. It is distant 379 miles from Adelaide, and 169 miles from Port Augusta, these measurements being made along the railway.

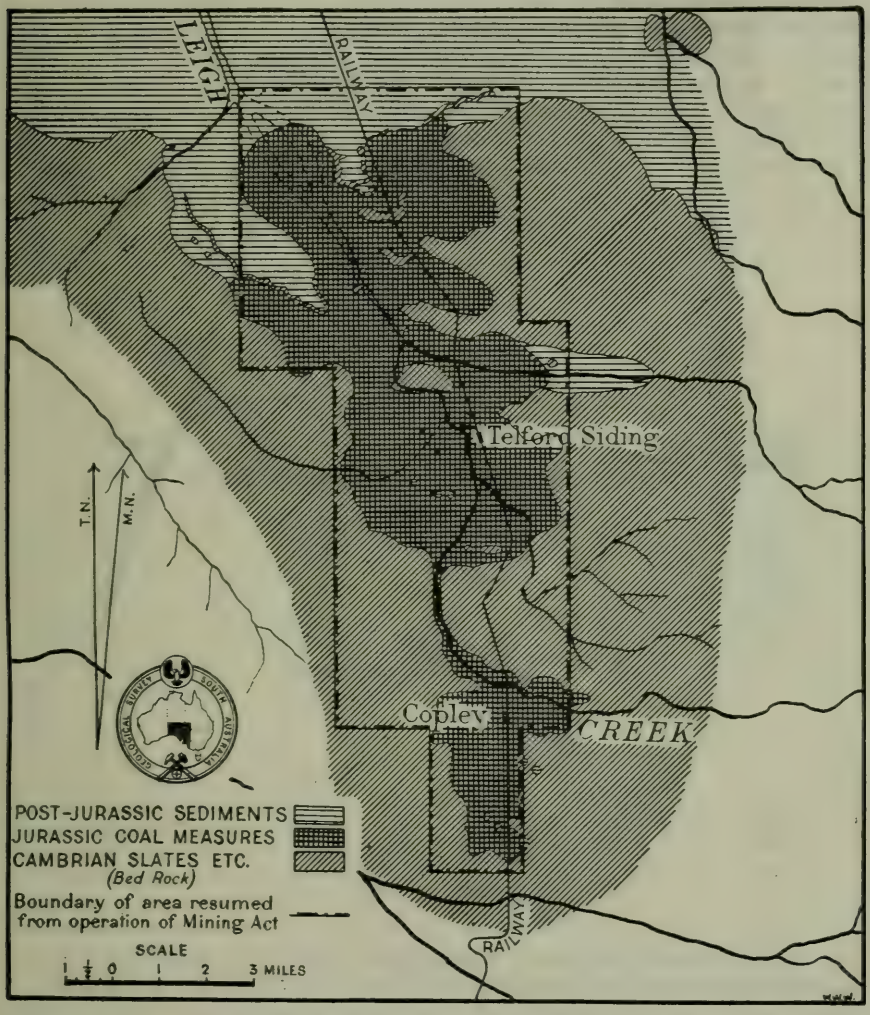
The coal field occupies portion of a broad valley, enclosed within the highlands of Flinders Range. Leigh Creek, an intermittent stream that flows only after heavy rain, descends from the higher ground to the eastward, and after crossing the northern portion of the southerly coal basin, traverses the northerly coal basin longitudinally.

Geological Features.—The depressions in which the coal measures have been laid down are of irregular form, as may be seen from the accompanying map, which is based on the geological map of Mr. H. Y. L. Brown. The area of the northerly basin, as determined by the planimeter on this map, is 36 square miles, and that of the southerly basin is 6.4 square miles. The northern basin, as shown, has a length of nine miles and a maximum width of five miles. The southern basin is four miles long, and its greatest width is two miles.

The strata constituting the coal measures dip towards the centre of each basin at low angles. From their contained fossils these coal-bearing rocks have been found to be of Jurassic age, and may therefore be correlated with the coal measures containing similar fossils in Queensland, New South Wales, Victoria, and Tasmania.

There are known to be several seams of coal in the northerly basin, but only one has yet been worked. The vertical sections obtained by boring,

and published herewith, show the various seams of which definite knowledge has been gained. The principal seam is a very thick one, the thickness being 33ft. (including a band of shale) at the No. 1 Shaft and bore; 47ft. 10in. at the No. 2 bore; 38ft. 3in. at the No. 3 bore; and 45ft. in the principal workings at the place where sampling was carried out as described in this report.



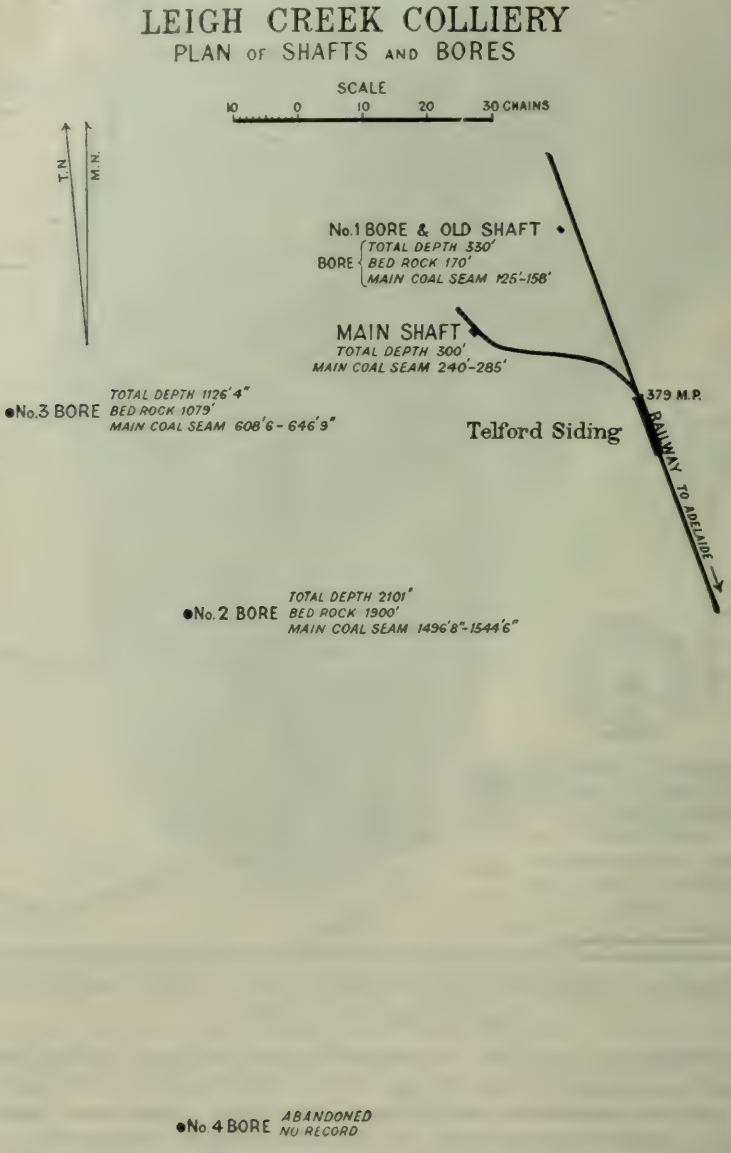
GEOLOGICAL SKETCH MAP OF THE LEIGH CREEK COAL FIELD.

Boundaries after H. Y. L. Brown.

The inclination of the coal measures towards the centre of the northern basin has been caused by the collapse of the central part of the basin. Following upon the subsidence and filling of the basin, a number of small fractures have caused the dislocation of the beds. These faults are to be seen in the mine workings, and the nature of the displacement can be ascertained where exposures of the roof occur. The fractures traversing the main body of the coal are recognisable only by the presence of slickensided surfaces. Many of the faults which show exposures of the roof are reverse faults. That is to say, in following the top coal down the dip the roof of

the dislocated portion on the far side of the fault is found to be at a higher level. At least one normal fault was, however, observed.

The coal measures contain a small amount of saline water, which is too highly mineralised for use in boilers. As the workings were drained, the water was found to be confined to the shale forming the floor. No water exudes from the coal itself in the mine openings. The total quantity of water is relatively small, and the water level in the old workings was easily reduced by baling during recent mining operations.

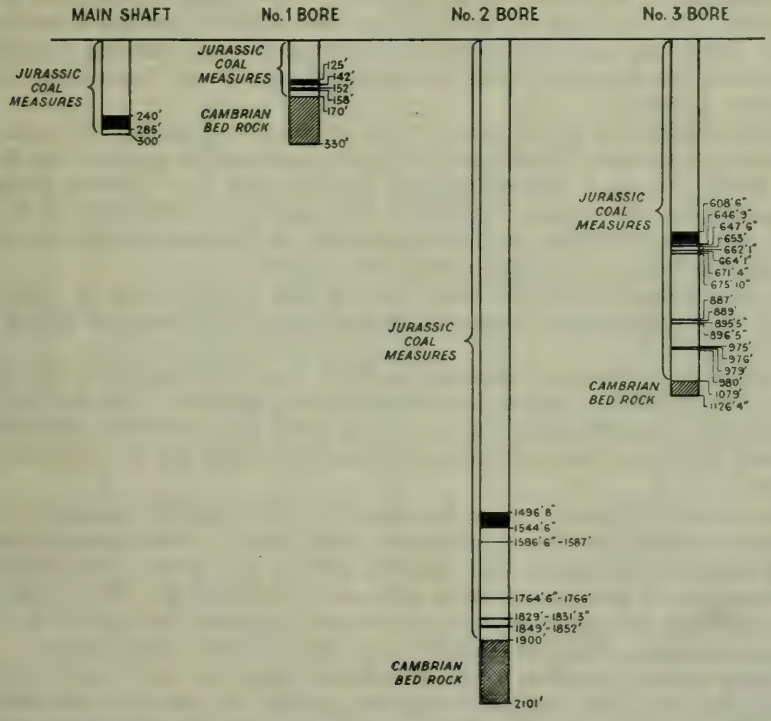


PORTION OF COAL FIELD, SHOWING EXPLORATORY WORK.

Exploration of the Field.—Nearly all the exploratory work that has been carried out has been restricted to the northern of the two basins. In the southerly basin a shaft was sunk in the early days of the field near the

Government and railway dams. A depth of 70ft. is stated to have been attained, but the influx of water discouraged any further attempt at this place. Thin seams of coal are reported to have been found, and the spoil heap contains carbonaceous shale. No boring has been done in this southerly basin.

The first bore was drilled at a site close to the railway line, and 29 chains N. of Telford Siding. The total depth of this bore is 330ft.; the main seam was entered at 125ft.; between 150ft. and 151ft. a band of shale was found; between 151ft. and 158ft., the lower portion of the seam was penetrated. The records preserved in the Department of Mines indicate that the coal seam is separated from bed rock by 12ft. of shale. Drilling was continued through blue clay slate to the bottom of the bore. The first shaft was sunk on the site of the No. 1 bore, but there is no record of the details of the underground workings. The head of the shaft has caved in, and no underground investigations are now possible.



SECTIONS OF COAL MEASURES IN SHAFT AND BORES.
Coal seams are shown in black; depths from surface in feet and inches.

The second bore was drilled at a site 83 chains distant in a south-westerly direction from No. 1 shaft. This borehole passed through 1,496ft. 8in. of shale, carbonaceous in part, before meeting the principal seam, which is 47ft. 10in. thick at this place. The bore was continued and penetrated the underlying shales, which carry thin seams of coal (1ft. 6in., 2ft. 3in., and 3ft.) to a total depth of 1,900ft. At this point bedrock, consisting of argillaceous sandstone and slate, was entered. The borehole was abandoned when a total depth of 2,101ft. had been reached. The No. 3 borehole, drilled in 1911, is situated 41 chains to the N.W. of No. 2 borehole. It pierced 608ft. 6in. of shales, some of which are recorded as being carbonaceous, before penetrating the principal seam. This main seam extends downwards to 646ft. 9in., and there are further bands of coal interstratified with shale to a depth of 675ft.

10in. Below this depth again thin seams of coal were passed through, the lowest being at a depth of 980ft. Bed rock was entered at 1,079ft., and boring was discontinued at 1,126ft. 4in.

The borehole marked on the plan accompanying this report as No. 4, is 80 chains S. of No. 2 borehole. No record has been kept of the results obtained at this place, but it is understood that the hole was abandoned owing to an accident which involved the loss of the boring tools in the hole.

The main shaft was sunk at a point 27 chains W.N.W. of Telford Siding, with which it is connected by a railway line. The shaft is vertical, and 300ft. deep, and workings extend from it at 258ft. and 285ft. From the lower level other workings extend to a greater depth, being reached by an underlie shaft, which is the downward continuation of the main south-western drive from the shaft.

An area of 10,000 acres was granted as a coal lease to W. R. Sando on July 1st, 1889, under Act No. 26 of 1870-1871. Prior to the issue of the lease instrument the lease was transferred to the Leigh Creek Coal Mining Company, N.L., on July 1st, 1893. The lease granted was for a term of 15 years. This lease was subsequently transferred to John Darling, on January 13th, 1906. On July 6th, 1906, it was transferred to the Tasmanian Copper Company, Limited.

On the expiration of this lease it was decided to withdraw the coal field from the operations of the Mining Act by a proclamation gazetted on August 27th, 1908. The area thus withdrawn was enlarged by a further proclamation gazetted on November 1st, 1917. The total area withdrawn from mining is 80½ square miles, and the boundary of this area is shown on the geological sketch map accompanying this report.

The production from the mine, during the period when it was being worked by the Tasmanian Copper Company, was 12,455 tons, of which 8,304 tons were sold.

Subsequent to the reservation of the field, two parcels of coal were raised by the Department of Mines for experimental purposes. The first of these parcels, raised in 1913, consisted of only 5¾ tons. The mine was again opened in April, 1917, and was worked until December 13th, for a total output of 713 tons.

The Colliery Workings and Equipment.—The mine is equipped with a Lancashire boiler, 6ft. 6in. in diameter, 26ft. long; a loose-eccentric engine, 3ft. stroke, 16in. cylinder, 6ft. winding drums, one loose. The engine can be thrown out of gear for winding and used for pumping. The recent hauling and baling were carried out by means of a vertical boiler, 6ft. by 10ft., driving a double-cylindered geared winch, 8in. cylinder, 12in. stroke.

A brick-making machine has been installed near the main shaft, with the original intention of making briquettes, but it is doubtful whether any briquettes were ever produced by its aid. A small reverberatory furnace has been built near the boiler

The headgear of the shaft, which was badly out of repair, has been put into working order.

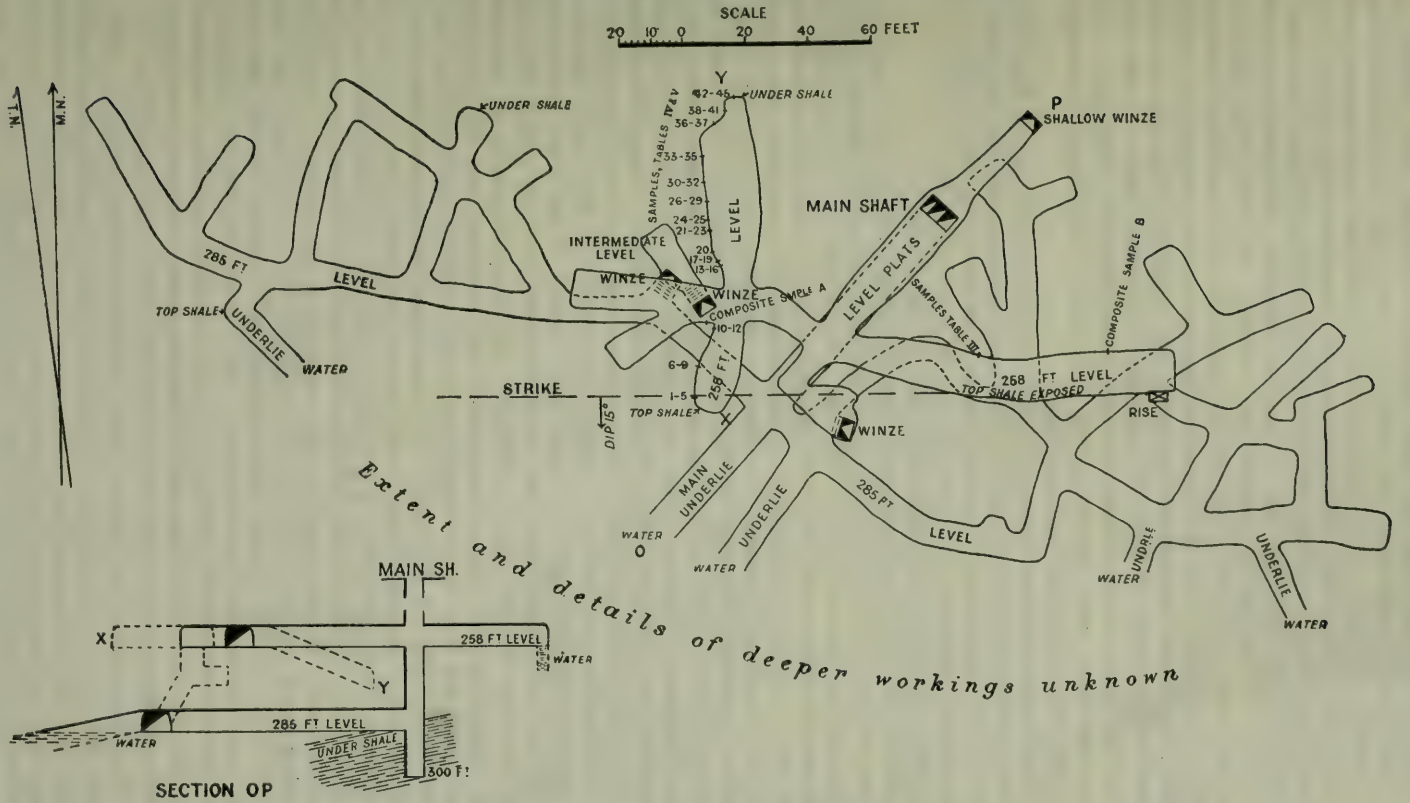
The main shaft is divided into three compartments. It is close timbered, and its dimensions are 11ft. by 6ft. in the clear. One compartment, during the working of the mine, was used as an upcast in the scheme of the ventilation. The shaft has been left in thorough repair to the 285ft. level, and all the timber has been secured. The top brace is sufficiently elevated to enable the coal to be tipped directly into the railway trucks, which are brought to the side of the shaft on the branch line shown on the plan.

The following descriptive notes deal only with the workings on the 258ft. and 285ft. levels, which are both shown on the plan printed with this report.

258*ft. Level.*—The main drive from the shaft runs in a south-westerly direction, apparently with the intention of following the dip of the seam,

LEIGH CREEK COLLIERY

PLAN OF UPPER AND PORTION OF LOWER WORKINGS



WORKINGS AT MAIN SHAFT.

before the strike and dip in this part of the field had been ascertained. However, exposures of the roof shale on this level show clearly that the strike is nearly east-west, and the dip southerly at an angle of 15deg. Reference to the plan of the workings will show that one crosscut, to the W. of the shaft, practically coincides with the direction of the dip. This crosscut was found convenient for the detailed vertical sampling of the seam. During the latter stages of the working of the mine, the eastern drive was extended for the special purpose of winning coal from the uppermost 6ft. of the seam. Various connections with the lower workings shown on the plan were made with the object of improving the ventilation. All the coal sent away from the mine for experimental purposes was obtained from this level. The whole of the workings are within the limits of the coal seam. They are not strictly on one level, and the northerly crosscut, to the W. of the main shaft, was depressed with the object of cutting the floor shale more quickly than if driven horizontally.

During the earliest stages of the recent work at the mine, coal was raised for experimental purposes from the eastern drive and the two ends of the meridional crosscut at the 258ft. level. As soon, however, as the results of the earliest sampling were available, the coal railed from the mine was obtained wholly from the uppermost 6ft. of the seam.

285*ft. Level.*—The lower workings are considerably more extensive than those referred to above. There are several drives and crosscuts extending in a general direction of E.S.E.-W.N.W. All are wholly in coal, and many are driven on a rise or dip, but without apparent relation to the stratification of the coal. A number of inclined drives descend below water level, and could not be inspected. Several of these are probably connected at lower levels, but no plans of the deeper workings are available. It is noticeable that the main underlie shaft which connects with the vertical shaft does not follow the direction of the dip. The only exposures of the roof and floor shales at this level are in the workings W. of the main shaft. One of the connections between the 258ft. and 285ft. levels gives access to a short intermediate level.

The faulting of the coal, to which reference has been made above, adds a little inconvenience to the winning of the coal. If the seam be regarded as a workable body throughout its whole thickness, the only difficulties raised by the faulting will be those connected with the fracturing of the roof and the irregularities in the excavations. The fractured roof shale requires support, and the coal which elsewhere forms a sound roof requires timber in the neighborhood of the faults. It seems probable that, with extensive workings, the roof shale will require to be held up, even in areas not affected by faulting. The alternative of leaving a portion of the seam to form a sound roof to the workings has the disadvantage of sacrificing some of the best quality coal. If the mine is to be worked for the top 6ft. of the seam the difficulties of mining caused by the faulting will be much more serious, since a relatively small vertical displacement will suddenly bring the workings into the lower coal of poorer grade. The amount of vertical displacement in the case of overthrust faults, in such instances, can be determined most quickly by boring for the roof of the displaced portion of the seam; and the workings may be designed in accordance with the data secured.

The Sampling of the Seam.—The meridional crosscut on the 258ft. level to the W. of the main shaft offered a peculiarly favorable exposure for the systematic vertical sampling of the seam through its entire thickness. In fact, the northern end of this crosscut was slightly extended in order to give the complete section. The samples were, in all cases, obtained by cutting a groove over a measured thickness on freshly-cut faces. The samples were

broken down, quartered, and placed in lever-top containers as soon as cut, all these operations being rapidly carried out underground. The containers were not unsealed until the moment of assaying. The analyses of the undried samples therefore represent the composition of the coal as mined. The analyses of the air-dried samples are comparable with those of the drill cores where special precautions were not taken to prevent the evaporation of the moisture. These analyses of air-dried coal give also some indication of the extent to which the natural moisture is removed by exposure, while the coal is protected from rain and the direct action of the sun's rays.

The mine openings suitable for sampling necessitated the breaking of the sample cut across the thickness of the seam into a number of component cuts, from 1ft. to 5ft. in length, and separated by irregular intervening distances measured along the dip of the seam. These component cuts are shown in the diagram on page 44.

The splitting up of the sample cut across the seam may possibly have introduced some duplication of portion of the seam through faulting; but the only sign of faulting observed on the line of the section was a slicken-sided surface between samples Nos. 12 and 13 of Tables IV. and V.

A preliminary sampling was undertaken by the Chief Inspector of Mines, and a series of five samples was cut from the whole thickness at that time exposed. These samples were submitted to the Director of Chemistry for analysis, and the following results were received:—

TABLE I.

Sample No.	Length in Feet.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.	Total.
1	0 to 5	35·4	25·2	33·5	5·9	100·0
2	5 10	30·9	22·2	36·2	10·7	100·0
3	10 15	28·4	19·0	34·8	17·8	100·0
4	15 20	28·2	19·2	36·5	16·1	100·0
5	20 24·8	31·3	19·8	36·7	12·2	100·0

The total thickness thus sampled was 24.8ft.

The descriptive notes accompanying these samples are:—

No. 1. From the top shale to a depth of 5ft.; bright seamy coal; no dirt visible.

No. 2. From 5ft. to 10ft. from the roof; top portion resembles No. 1; lower 3ft., duller and tougher.

No. 3. From 10ft. to 15ft. from the roof; coal duller, and two small seams of dirt each ¼in. thick.

No. 4. From 15ft. to 20ft. from the roof; resembles No 3, with a few brighter seams.

No. 5. From 20ft. to 24ft. 8in. from the roof; similar to No. 3, with a small seam of pyrite.

These results and the marked difference in quality between the uppermost 5ft. and the underlying coal pointed to the necessity for closer sampling, and this work was put in hand. The Chief Inspector of Mines then cut a second series of samples, which were submitted to the Director of Chemistry for analysis. The results furnished are as follows, the samples being taken in the same order, beginning with the uppermost foot of the seam, and ending at a distance of 28ft. from the roof (measured at right angles to the dip) :—

TABLE II.

Sample No.	Sample Cut. Length in Feet.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.	Total.
1	0 to 1	34·4	23·1	35·2	7·3	100·0
2	1 2	32·6	25·3	34·2	7·9	100·0
3	2 3	35·5	24·1	31·3	9·1	100·0
4	3 4	35·6	24·4	35·1	4·9	100·0
5	4 5	35·3	23·6	36·3	4·8	100·0
6	5 6	32·6	22·5	37·0	7·9	100·0
7	6 7	25·1	23·1	34·3	17·5	100·0
8	7 8	24·6	22·2	34·2	19·0	100·0
9	8 9	28·0	21·2	36·4	14·4	100·0
10	9 10	26·5	20·8	33·7	19·0	100·0
11	10 11	27·4	20·3	34·1	18·2	100·0
12	11 13	28·0	19·2	35·0	17·8	100·0
13	13 15	25·9	22·6	34·6	16·9	100·0
14	15 19	31·1	20·9	35·1	12·9	100·0
15	19 23	32·0	20·4	36·6	11·0	100·0
16	23 28	29·5	19·1	38·4	13·0	100·0

Another series of samples was gathered from the top coal, at the same level, at a point 88ft. to the eastward. This series embraces samples taken over the top 8ft. of coal, the measurement being made as in other cases at right angles to the dip of the seam.

The results of the analysis of this coal by the Director of Chemistry are shown in the following table:—

TABLE III.

Sample No.	Length in Feet.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.
1	0 to 2	33·8	23·7	34·2	8·3
2	2 4	34·3	26·9	34·3	4·3
3	4 5	34·1	24·1	36·5	5·3
4	5 6	32·1	22·1	36·4	9·4
5	6 7	25·3	20·2	30·3	24·2
6	7 8	29·1	20·9	34·9	15·1

At a subsequent date, after the under shale had been exposed at the northern end of the meridional crosscut at the 258ft. level, a check sampling was carried out by the Government Geologist and Chief Inspector of Mines.

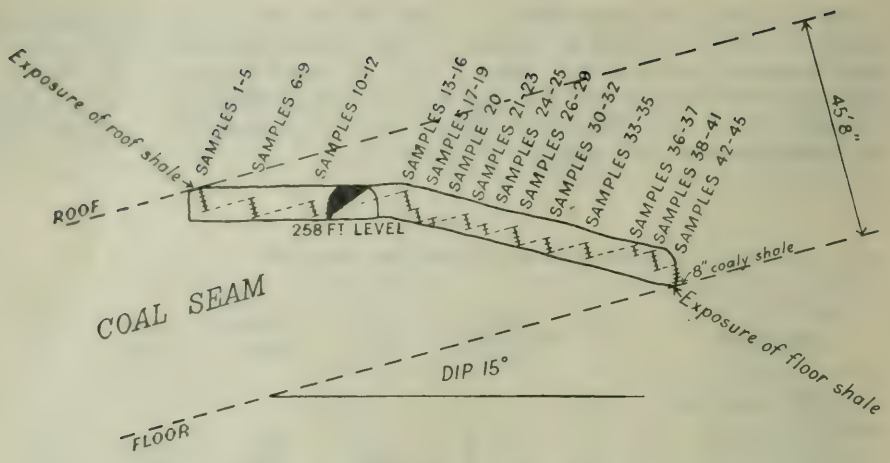
The whole thickness of the seam was sampled in 1ft. sections. The accompanying diagram explains the method of sampling, and shows each sample cut in its proper position. In each case the length sampled was measured in a direction normal to the dip of the coal (15deg.).

The samples were submitted to Mr. W. S. Chapman, Departmental Analyst, and the results are shown in the following tables. The samples were unsealed, crushed, and assayed with all possible expedition. The remainders were then spread out in a thin layer and air-dried without direct exposure to the sun. The dried samples were then separately assayed, and the results appear in a separate table, No. V.

TABLE IV.

ANALYSES OF UNDRIED SAMPLES.

Sample No.	Depth from Roof in Feet.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.
Roof.					
1	0 to 1	31·55	26·71	34·91	6·83
2	1 2	28·59	28·12	33·26	10·03
3	2 3	29·91	27·27	37·65	5·17
4	3 4	31·20	31·36	31·64	5·80
5	4 5	29·92	28·93	35·27	5·88
6	5 6	31·28	33·06	30·87	4·79
7	6 7	29·85	28·65	32·97	8·53
8	7 8	25·61	25·85	36·00	12·54
9	8 9	22·23	23·30	30·61	23·86
10	9 10	23·82	23·32	35·36	17·50
11	10 11	22·29	24·31	33·34	20·06
12	11 12	21·81	23·47	34·80	19·92
13	12 13	28·15	23·68	39·13	9·04
14	13 14	23·36	24·52	32·35	19·77
15	14 15	23·70	23·87	31·27	21·16
16	15 16	23·65	27·37	32·54	16·44
17	16 17	23·54	23·59	33·63	19·24
18	17 18	20·22	22·94	36·29	20·55
19	18 19	23·12	21·39	32·97	22·52
20	19 20	23·16	24·72	33·10	19·02
21	20 21	26·80	22·39	39·46	11·35
22	21 22	26·32	26·18	36·22	11·28
23	22 23	29·08	25·08	37·20	8·64
24	23 24	30·01	24·13	35·80	10·06
25	24 25	30·78	24·62	35·39	9·21
26	25 26	31·49	23·51	35·46	9·54
27	26 27	32·86	25·95	31·68	9·51
28	27 28	21·54	22·97	33·46	22·03
29	28 29	27·26	24·50	34·66	13·58
30	29 30	26·14	27·08	33·45	13·33
31	30 31	25·94	24·52	35·38	14·16
32	31 32	26·61	23·81	37·12	12·46
33	32 33	24·70	23·11	32·12	20·07
34	33 34	27·02	25·47	33·27	14·24
35	34 35	27·94	25·10	32·10	14·86
36	35 36	28·26	27·64	30·60	13·50
37	36 37	28·86	22·06	34·62	14·46
38	37 38	32·95	27·53	31·33	8·19
39	38 39	25·75	25·34	29·31	19·60
40	39 40	30·50	24·47	32·73	12·30
41	40 41	27·10	23·34	32·92	16·64
42	41 42	26·15	21·69	34·57	17·59
43	42 43	29·52	25·38	32·57	12·53
44	43 44	30·88	27·22	27·74	14·16
45	44 45	30·66	26·58	28·68	14·08
8in. of coaly shale					
Floor.					



Analyses of Samples appear in Tables IV & V

SCALE

20 10 0 20 40 60 FEET

LEIGH CREEK COLLIERY, SECTION ON LINE XY

Showing sample cuts.

TABLE V.

ANALYSES OF AIR-DRIED SAMPLES.

Sample No.	Depth from Roof in Feet.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.
Roof.						
1	0 to 1	16·28	29·72	45·22	8·78	0·31
2	1 2	14·90	30·02	43·19	11·89	0·37
3	2 3	15·79	31·96	45·88	6·37	0·28
4	3 4	15·61	31·69	45·76	6·94	0·36
5	4 5	15·68	31·63	45·83	6·86	0·37
6	5 6	16·94	30·96	46·90	5·20	0·28
7	6 7	15·31	33·35	40·95	10·39	0·66
8	7 8	14·46	27·70	43·43	14·41	0·19
9	8 9	12·06	26·50	35·04	26·40	0·14
10	9 10	13·00	26·03	40·89	20·08	0·28
11	10 11	12·72	26·16	38·73	22·39	0·16
12	11 12	13·03	24·03	41·00	21·94	0·14
13	12 13	17·72	27·23	44·73	10·32	0·19
14	13 14	16·02	24·38	37·83	21·77	0·14
15	14 15	14·51	25·24	36·80	23·45	0·13
16	15 16	16·87	26·60	38·68	17·85	0·19
17	16 17	14·92	23·26	40·35	21·47	0·12
18	17 18	12·87	27·92	36·57	22·64	0·10
19	18 19	14·42	23·32	37·22	25·04	0·11
20	19 20	13·54	29·21	35·69	21·56	0·14
21	20 21	15·77	27·94	43·13	13·16	0·18
22	21 22	18·30	25·62	43·56	12·52	0·56
23	22 23	16·13	29·55	44·05	10·27	0·31
24	23 24	16·24	27·67	44·07	12·02	0·32
25	24 25	17·51	26·64	45·00	10·85	0·16

TABLE V.—*continued.*

ANALYSES OF AIR-DRIED SAMPLES—*continued.*

Sample No.	Depth from Roof in feet.		Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.
26	25	26	18·22	25·85	44·70	11·23	0·20
27	26	27	16·58	31·16	40·35	11·91	0·23
28	27	28	12·38	25·04	37·69	24·89	0·13
29	28	29	14·80	28·13	41·07	16·00	0·14
30	29	30	15·61	27·58	41·40	15·41	0·19
31	30	31	11·91	26·23	44·91	16·95	0·22
32	31	32	12·20	27·80	45·08	14·92	0·15
33	32	33	11·32	25·48	39·58	23·62	0·27
34	33	34	12·32	27·45	42·45	17·78	0·25
35	34	35	11·86	28·18	41·98	17·98	0·19
36	35	36	12·26	27·81	43·09	16·84	0·23
37	36	37	11·84	27·85	42·39	17·92	0·26
38	37	38	13·37	30·71	45·40	10·52	0·50
39	38	39	15·31	23·81	38·67	22·21	0·21
40	39	40	11·37	29·80	42·97	15·86	0·26
41	40	41	12·22	25·14	42·42	20·22	0·16
42	41	42	10·92	25·82	41·92	21·34	0·17
43	42	43	11·98	29·48	43·00	15·54	0·35
44	43	44	11·95	29·52	40·44	18·09	0·31
45	44	45	11·43	31·97	38·75	17·85	0·21
8in. of coaly shale Floor.							

In addition to the series of 1ft. samples, two composite samples over the uppermost 6ft. of the seam on the 258ft. level were cut; one sample cut being west of the main crosscut from the shaft, and the other east of that crosscut. These were similarly assayed by the Departmental Analyst, with the following results:—

TABLE VI.

ANALYSES OF COMPOSITE SAMPLES, 258FT. LEVEL.

Position of Sample.	Thickness Sampled in Feet.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.	
A.—West side.	6	29·76	28·37	34·54	7·33	—	Undried
B.—East side..	6	29·42	27·17	35·45	7·96	—	Undried
A.—West side.	6	19·16	29·09	43·03	8·72	0·50	Air-dried
B.—East side..	6	18·02	29·30	43·51	9·17	0·38	Air-dried

The results of the analyses of all the samples referred to above have been averaged in groups for convenience of comparison, and are shown in the following tables. The tables showing particulars with regard to the air-dried samples contain also averaged results of the analyses of samples from the No. 2 and No. 3 bores.

Table VII.

AVERAGES OF UNDRIED COAL SAMPLES.—TABLES I. to VI.

Sample.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.
First 5ft. section taken of top coal (Table I.) ..	35·4	25·2	33·5	5·9
Average of 1ft. samples of top 5ft. of coal, same place (Table II.)	34·6	24·1	34·4	6·8
Average of 1ft. samples of top 5ft. of coal, same place (Table IV.)	30·23	28·47	34·54	6·74
Average of 1ft. and 2ft. samples of top 5ft. of coal, east end (Table III.)	34·0	25·0	34·7	6·1
Average of 1ft. samples of top 6ft. of coal, first locality (Table II.)	34·3	23·8	34·8	6·9
Average of 1ft. samples of top 6ft. of coal, same place (Table IV.)	30·40	29·24	33·93	6·41
Average of 1ft. and 2ft. samples of top 6ft. of coal, east end (Table III.)	33·7	24·5	34·9	6·6
Average of composite 6ft. samples (Table VI.).	29·59	27·77	34·99	7·65
Average of 1ft. samples of top 7ft. of coal (Table II.)	33·0	23·7	34·7	8·5
Average of 1ft. samples of top 7ft. of coal, same place (Table IV.)	30·32	29·15	33·79	6·71
Average of 1ft. and 2ft. samples of top 7ft. of coal, east end (Table III.)	32·5	23·9	34·5	9·1
Average of 1ft. samples of top 8ft. of coal (Table II.)	31·9	23·5	34·7	9·8
Average of 1ft. samples of top 8ft. of coal, same place (Table IV.)	29·73	28·74	34·07	7·44
Average of 1ft. and 2ft. samples of top 8ft. of coal, east end (Table III.)	32·1	23·5	34·4	9·9
Average of 1ft. samples of top 9ft. of coal (Table II.)	31·5	23·2	34·8	10·3
Average of 1ft. samples of top 9ft. of coal, same place (Table IV.)	28·90	28·13	33·68	9·27
Average of 1ft. samples of top 10ft. of coal (Table II.)	31·0	23·0	34·7	11·1
Average of 1ft. samples of top 10ft. of coal, same place (Table IV.)	28·39	27·65	33·85	10·09
Average of 1ft. samples of top 11ft. of coal (Table II.)	30·6	22·7	34·7	11·8
Average of 1ft. samples of top 11ft. of coal, same place (Table IV.)	27·84	27·35	33·80	10·99
Average of total samples of top 28ft. of coal (Table II.)	30·1	21·2	35·7	12·8
Average of total samples of top 28ft. of coal, same place (Table IV.)	26·62	25·40	34·37	13·58
Average of total 1ft. samples taken over full thickness of seam (Table IV.)	27·15	25·24	33·68	13·91

Table VIII.

AVERAGES OF AIR-DRIED COAL SAMPLES.

Sample.	Water at 105° C.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.
Average of 1ft. samples of top 5ft. of coal (Table V.)	15·65	31·0	45·19	8·16	0·34
Average of top 5·5ft. of coal, No. 3 Bore (Table X.)	12·6*	32·2	39·1	15·8	—
Average of top 5·6ft. of coal seam, No. 2 Bore (Table IX.)	21·0*	32·6	43·0	3·1	—
Average of top 6ft. of coal (Table V.)	15·86	30·99	45·46	7·67	0.33
Average of composite 6ft samples (Tables VI.)	18·59	29·20	43·27	8·94	0·44
Average of top 6·6ft. of coal seam, No. 2 Bore (Table IX.)	20·5*	32·0	42·0	5·2	—
Average of top 7·5ft. of coal, No. 3 Bore (Table X.)	13·1*	32·5	41·3	12·8	—
Average of top 7ft. of coal (Table V.)	15·78	31·33	44·81	8·06	0.37
Average of top 7·6ft. of coal, No. 2 Bore (Table IX.)	20·6*	31·5	41·3	6·2	—
Average of top 8ft. of coal (Table V.)	15·62	30·87	44·64	8·85	0.35
Average of top 9ft. of coal (Table V.)	15·22	30·39	43·57	10·80	0.33
Average of top 9·6ft. of coal, No. 2 Bore (Table IX.)	20·0*	30·8	41·6	7·1	—
Average of total coal analysed, 22·4ft. at No. 2 Bore (Table IX.)	18·3*	27·9	42·2	11·2	—
Average of total coal seam (Table V.).....	14·23	27·75	41·75	16·25	0·24
Average of total coal seam, as shown by No. 3 Bore, representing 38·2ft. (Table IX.)	13·5*	31·7	35·7	18·7	—

* Water at 100° C.

In order that the results of the analyses of the samples recovered by boring may be conveniently compared with the results obtained from the mine workings, a few averages have been included in Table VIII. The details are reprinted in the following tables:—

Table IX.

ANALYSES OF SAMPLES OBTAINED FROM No. 2 BORE.

Depth from Surface.	Sample Length in Feet.	Water at 100° C.	Volatile Matter.	Fixed Carbon.	Ash.
Ft. in. Ft. in.					
1,496 8 to 1,501 4	4·7	20·9	32·2	43·2	3·5
1,509 0 1,510 0	1·0	21·9	34·5	42·1	1·3
1,514 0 1,515 0	1·0	17·8	28·6	36·4	17·0
1,516 0 1,517 0	1·0	21·0	28·3	37·2	13·3
1,518 0 1,520 0	2·0	18·0	28·5	42·9	10·4
1,521 0 1,522 0	1·0	16·3	27·1	40·5	15·9
1,523 0 1,526 6	3·5	18·3	25·7	44·7	11·2
1,527 0 1,527 6	0·5	16·3	23·8	43·6	16·1
1,527 6 1,528 0	0·5	15·3	28·4	45·5	10·7
1,529 0 1,530 0	1·0	16·8	26·8	44·2	12·0
1,531 0 1,532 0	1·0	13·3	26·3	38·5	21·7
1,532 6 1,533 6	1·0	13·7	24·7	42·5	18·9
1,539 6 1,540 8	1·2	17·4	24·5	43·2	14·8
1,540 8 1,541 10	1·1	18·0	24·6	40·7	16·5
1,541 10 1,543 9	1·9	19·3	25·9	41·1	13·5

TABLE X.

ANALYSES OF SAMPLES OBTAINED FROM No. 3 BORE.

Depth from Surface in Feet.	Sample Length in Feet.	Water at 100° C.	Volatile Matter.	Fixed Carbon.	Ash.
608·5 to 609·0	0·5	13·19	38·58	40·76	7·47
609·0 612·0	3·0	12·00	29·85	40·03	18·12
612·0 614·0	2·0	13·40	34·55	37·41	14·64
614·0 616·0	2·0	14·76	33·30	47·45	4·49
616·0 619·0	3·0	12·40	33·16	36·42	18·02
619·0 623·0	4·0	11·78	28·94	32·94	26·34
623·0 625·0	2·0	13·54	31·86	31·44	23·16
625·0 627·5	2·5	13·90	27·78	39·40	18·92
627·5 629·5	2·0	13·85	30·89	35·48	19·78
629·5 631·0	1·5	15·79	34·42	29·69	20·10
631·0 633·5	2·5	14·92	40·52	29·95	14·61
633·5 635·5	2·0	12·80	29·70	33·40	24·10
635·5 637·5	2·0	14·74	30·60	33·79	20·87
637·5 639·0	1·5	13·12	32·28	26·18	28·42
639·0 642·5	3·5	13·69	29·10	36·01	21·20
642·5 645·5	3·0	14·50	32·52	37·89	15·09
645·5 646·75	1·2	17·48	32·87	41·22	8·43

Nature of the Coal and Method of Handling.—The uppermost portion of the coal seam contains a larger number of bright lustrous bands than the lower portion; although bands possessing a bright lustre do occur right through the seam. The duller coal is noticeably tougher than the lustrous variety. The seamlets of argillaceous matter do not occur in continuous and definite bands such as would enable them to be picked out and discarded during mining. They are small—few exceeding ½in. maximum thickness—and they merge gradually into the coal, both horizontally and vertically. It was therefore necessary to follow the customary practice in sampling, and to include the bands of dirt in the samples, as they would not be rejected in mining the coal. A small proportion of pyrites was noticeable in certain parts of the workings, in the form of lenticles. The coal seam possesses no definite cleavage at right angles to the bedding, and this absence of "cleat" renders it difficult to understand why the main underlie shaft below the 285ft. level was sunk in a half-course direction.

As regards the classification of the coal, it will be seen from the analyses that there are difficulties to be overcome. The black color and the bands of bright lustrous coal indicate its affinities with the bituminous coals. The relatively high water content indicates its relationship to the lignites. The nomenclature of such coals has been discussed in some detail without the attainment of any general consensus of opinion on the subject. Perhaps the term "sub-bituminous" proposed by Marius R. Campbell (Economic Geology, Vol. III., No. 2, 1908, page 134) is the most suitable to be applied to the Leigh Creek coal. According to M. R. Campbell's definition, sub-bituminous coals are those which have characteristics intermediate between those of the bituminous coals (which contain less water) and the typical lignites (which are of brown color, woody texture, and contain a noteworthy proportion of water). Sub-bituminous coals break up irregularly on drying, and exhibit poor cleavages. It may be therefore correct to classify the Leigh Creek coal as a sub-bituminous coal—a group which admittedly embraces coals possessing slightly varying characteristics.

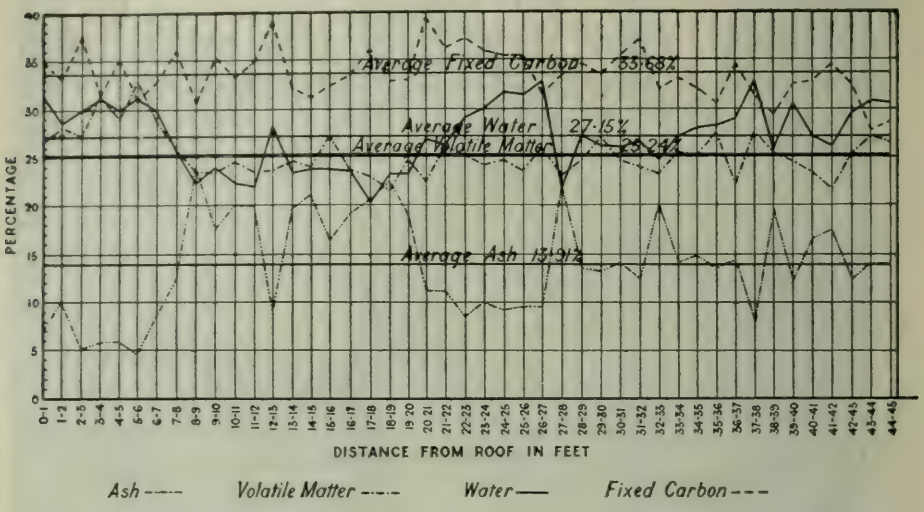
The impression made by the observation of recent mining operations is that the proportion of small coal to large is relatively high. It is, of course probable that, with a greater familiarity with the character of the coal, mining practice would be considerably improved in this respect.

Graph showing variations in the percentage composition of the coal as mined in successive foot samples from roof to floor. Based on figures in Table IV.

The coal that has been mined and railed to Adelaide without any special measures or precautions having been taken to prevent disintegration has been found to crumble fairly rapidly to very fine coal. Hence the need for the full investigation of the possibility of obtaining efficient briquettes at a cost that will allow a margin of profit.

The coal railed to Adelaide during the early part of recent mining operations was dispatched in bulk as mined. Subsequently, however, the coal was screened in the face, hauled to the surface, broken to 2in. to 3in. gauge, bagged, and on its arrival in Adelaide stacked under cover.

Conclusion.—The Leigh Creek coalfield embraces a very large area, the major portion of which remains altogether unprospected. No records whatever have been preserved with regard to the thickness and quality of the coal in the southern portion of the field; and in the northern basin all the workings that have penetrated the coal are included in an area of 180 acres. It is, therefore, clear that there is abundant scope for exploratory work, which should be carried out in the first instance by a drill capable of producing cores.



Graph showing percentages of water, volatile matter, fixed carbon, and ash in coal as mined, in successive foot samples from roof to floor. Based on figures in Table IV.

Although much prospecting yet remains to be done before the full potentialities of the field can be said to be known, it is improbable that further prospecting will result in the discovery of coal of a different character from that already exposed in the mine workings or known from the drill cores. It has been often asserted that the existing mine workings have only to be deepened to secure coal of better quality. However, this argument is stultified by the actual facts proved by boring. The character of the coal from a depth of 1,500ft. (No. 2 bore) can be seen, from the tables of analyses printed in this report, to be essentially the same as that revealed by samples cut in the mine workings.

The general conclusions to be drawn from the facts now ascertained are:—

(*a*) The top 6ft. of the coal seam contain the best coal.

(*b*) The best coal obtainable needs special handling in order to minimize the disintegration that follows upon exposure.

The Committee appointed to enquire into the commercial availability and economic utilization of the coal is giving detailed consideration to the many problems concerned with the handling and treatment of the coal.

Whatever be the outcome of the investigations now in progress, the feasibility of working the coal at a profit will be almost wholly governed by the freight rates on the railways. On inquiry from the South Australian Railways it has been ascertained that the following rates are at present in

force for coal in truckloads of not less than 6 tons carried from Telford Siding to the following specified stations:—

Destination.	Miles from Telford.	Rate per Ton.
		s. *d.*
Copley	6	1 8
Quorn	145	10 8
Port Augusta	169	12 2
Peterborough	225	15 1
Port Pirie	298	18 7
Cockburn	370	21 11
Port Adelaide	377	22 2
Mile End	379	22 4
Kadina	344	20 9
Wallaroo Mines	345	20 9
Wallaroo	350	21 0
Yelta	361	21 6
Moonta	361	21 6

Other questions concerned with the exploitation of the coal on a large scale are those dealing with water supply and mining timber.

During the former period of activity at the mine, water was stored in a dam excavated in a gully immediately to the N. of the mine. This dam has now fallen into disrepair. Mining timber occurs in limited quantities in the beds of the watercourses of the district.

In the calculation of mining costs, the water content of the coal must be remembered, since a proportion of the weight of coal that is raised from the mine will be lost subsequently by evaporation. (17-1-18.)

REPORTS

BY THE

Assistant Government Geologist (R. Lockhart Jack, B.E., F.G.S.)

THIRD INSPECTION OF THE GRAPHITE LOCALITIES OF EYRE'S PENINSULA.

A third visit to inspect the main graphite localities was made in November, 1917, and several localities were seen for the first time.

A large number of claims have been pegged in the Port Lincoln district, and are shown on the accompanying sketch plan, which shows the claims held for graphite, and the freeholds on which graphite is known.

The group of claims starting at Sleaford Bay and running northwards, is on a band of gneiss, of sedimentary origin, garnetiferous in places, in which the flake graphite takes the place of mica. In portions of the zone, mica is present as well as flake graphite. Some very good flake graphite is present in this belt, but in many cases mica reduces the grade of the recoverable concentrates.

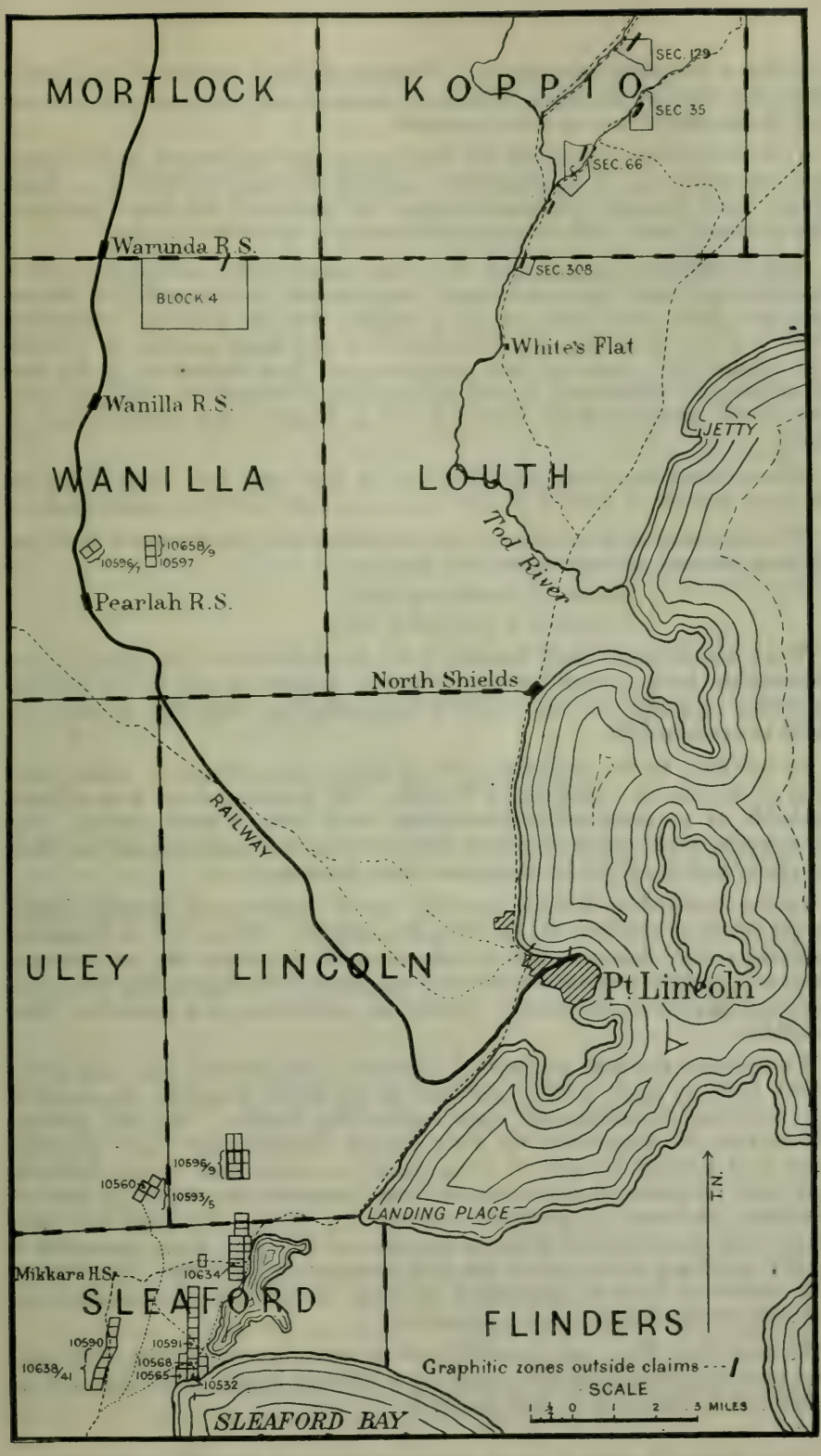
A second group to the west of Sleaford Mere, shows a little flake in hard ferruginous limestone, possibly superficial, but very little work has been done here.

Some miles to the north, in the hundred of Lincoln, a shaft on a group of claims, shows some flake graphite of good quality in gneiss. The formation is apparently of considerable size, but is much obscured by travertine. These groups may be provisionally assumed to be on one graphite zone, though the central group is doubtful, being too far to the east; while two groups of claims, two miles to the W., may represent a second zone.

The southerly group on this second zone has two shallow shafts sunk on a belt of rubbly graphitic laterite, which has a width of 150ft. to 200ft. The iron disappears in depth, and the flake, though not present in large amount in the shafts, is of good type, and the quality of the flake is good when not associated with mica. These shafts only prove 12ft. in width of the zone, and may not be on the best of it.

Three miles N. of this is a block of claims on a very large deposit, graphitic stones being visible over an area of several acres. The width of the zone here may be from 800ft. to 1,200ft. A shaft and crosscut shows that the material is graphitic gneiss, much decomposed as far as the workings have gone, and that the bands vary in richness. One band of 30in. yielded 12 per cent. of flake of very good quality, other portions are low grade, and others again are still ferruginous at the shallow depth at which they are exposed.

In the hundred of Koppio, where most of the mineral rights have been alienated from the Crown, a belt of graphitic rock extends for some miles from the hundred of Louth, along the Tod River and Rocky Valley Creek, and attains its maximum known development on section 35, Koppio. Flake of commercial quality has been obtained from a depth of 28ft. on this section. A second belt is seen on sections 129 and 122, and is stated to be traceable for some distance. A shaft shows 4½ft. of ore concentrating to 7½ per cent. of small flake assaying 71.2 per cent. carbon at a depth of 26ft., beside 6ft.



GRAPHITE CLAIMS AND LOCALITIES, PORT LINCOLN DISTRICT.

yielding a micaceous concentrate. Although the flake graphite is apparently good, the concentrate made is highly micaceous, and the two minerals can only be separated by expensive processes.

It is only to be expected in all these zones that richer and poorer bands will alternate, and it is absolutely essential, not only to sink to a depth below which limonite will cease to spoil the quality of the flake (estimated not to exceed 50ft.), but to crosscut in search of the better bands.

The longitudinal extent and the very considerable widths over which floaters occur, and the demonstrated improvement in the quality of the recoverable flake with depth, all go to suggest that the field for exploratory work is a very large one, and that there is a very good prospect of developing remunerative mines of flake graphite upon these zones; yet, at the time of the writer's inspection, despite the fact that 57 claims are held—in addition to the prospecting on alienated land in Koppio, only six men were at work.

Other claims have certainly had more or less work done upon them, but the total amount of work is wholly incommensurate with the possibilities.

The sum total of work done on the 57 claims, and the alienated land, excluding costeans and pits under 5ft. deep, is:—

Shafts, 15, averaging 22ft.
Crosscuts, 3, averaging 32ft.

Work has certainly been hampered by the wet winter, but even so, considering the keen demand for flake graphite, induced in part by its need for munition purposes, the total is very disappointing, especially as only one shaft is down to 50ft.

In addition to the localities outlined above, two groups of claims were seen on section 2N., hundred of Wanilla; the western group is on a body, probably of no great width, containing small flake of good quality. The other group is on a graphite schist body containing amorphous and not flake graphite, and is not likely to produce flake graphite.

In the hundred of Miltalie graphite occurs disseminated through felspathized schist on sections 51, 48, 43N, 43S, and 40. Three feet of formation carrying a little flake was seen at a depth of 8ft. on section 40, but the main body on the other sections contains the graphite in the amorphous form, and does not appear to be worthy of further attention, as a source of flake graphite.

The demand for flake graphite is insistent at the present time, and active search is being made in other portions of the world to supply the needs of the munition, metallurgical, and engineering trades. On the promise afforded by the deposits in the Port Lincoln district, much more attention than is at present devoted to them should be given, that South Australia may take its place as a producer of this important mineral. In 1915-16 blacklead plumbago or graphite and foundry facings imported into Australia were removed from bond to the value of £11,363. Duty amounted to £2,777, making a total cost to the local consumer of £14,140. The bulk of this market is open to Australian graphite, in addition to manufactured graphite products that are also imported.

To sum up:—There are graphite-bearing zones known to exist, with gaps that have not been prospected, over many miles in length, and ranging from a few feet to hundreds of feet in width.

The little work that has been done has demonstrated:—

1. That the flake graphite improves in quality below the superficial contamination with limonite.
2. That the large zones are made up of bands containing varying percentages of flake graphite.
3. That some of these bands are of payable grade.
4. That mica, though it may contaminate and render useless certain of the bands, is not uniformly distributed among the flake, and that bands of good graphite, free from this deleterious mineral, exist.
5. That the bodies being steeply inclined the chief function of a shaft is to give a starting point at a sufficient depth for the exploratory work of crosscutting.

Two claims may be said to have disclosed bodies of workable grade. In Uley, with 30in. proved, at a depth of 26ft., to contain 12 per cent. of flake, assaying 88.7 per cent. of carbon, and at section 35, Koppio, 6ft. at 28ft. in depth, containing 9.0 per cent. of flake assaying 82.8 per cent. of carbon. In each of these cases there are enormous graphite-bearing zones yet to be crosscut.

Other zones, notably the Sleaford line, and that two miles to the westward, that S.E. of Cobbler's Hill, and the zone extending from section 308 Louth to section 35 Koppio, are large, and well justify the mining risk of crosscutting across them.

In no case has the work done upon these zones been commensurate with their importance.

Other localities have had little more work done on them than was necessary to establish the presence of flake.

HUNDRED OF SLEAFORD.

Claim No. 10532, Yarranyacka Syndicate.

This claim is situated on the shore of Sleaford Bay, and includes the graphite bodies described as "Section 14A, hundred of Sleaford," on p. 60, Review No. 26.

Since the date of that report a shaft has been sunk to sea level, about 50yds. N. of the shore. Sunk to a depth of 53ft., the shaft passed through "Recent" material before entering the decomposed Pre-Cambrian rocks. It cut a lode near the bottom, dipping 50deg. to the westward. Some specimens showing very large flake, averaging from 3/16in. to 1/3in. across, have been obtained from this lode, but the bulk of the flake showing is considerably smaller. A sample taken from the eastern 4ft. 3in. of this "Shaft Lode" yielded 5.0 per cent. of flake assaying 48.1 per cent. of carbon, while one from the western 4ft. 3in. yielded 7.0 per cent. of flake assaying 59.3 per cent. of carbon.

A little limonite was present in the samples, which were soft, with occasional harder pieces.

Under the microscope the concentrate assaying 48.1 per cent. shows much of the flake to be dirty, and to be associated with about 5 per cent. of mica and a considerable amount of gritty particles (quartz).

The second sample of concentrates showed clean flake, very little mica, but a fair proportion of grit.

A crosscut extended 48½ft. to the westward, cut a second lode at 28ft. to 39½ft., after passing through barren, decomposed gneiss.

The following samples were taken:—

28ft. to 31½ft.—Brownish sandy clay, with small bright flake. Yield, 1.75 per cent. of concentrate, assaying 31.1 per cent. of carbon. Under the microscope the flake graphite appears to be good, but is mixed with a considerable proportion of dark mica, apparently 30 per cent. or more.

31½ft. to 35¼ft.—Similar to the preceding sample; 12½ per cent. of flake assaying 35.2 per cent. of carbon was obtained. There did not appear to be very much mica, but a good deal of grit was present in the concentrate

35¼ft. to 39½ft.—Similar material, yielded 9 per cent. of concentrate, assaying 59.0 per cent. of carbon. Under the microscope most of the flake was clean, only a little being ironstained, but about 5 per cent. of mica and much quartz grit was present.

This appears to be the lode sampled on the beach (Review No. 26), and is contaminated by mica, which is inseparable from the graphite. As far as may be judged, the graphite flake itself is of good quality, but the mica spoils the concentrate obtained.

The next 3ft. contains a little flake and a very large proportion of mica. The face shows only a little flake.

Salt water is standing in the sump of the shaft, and it is stated that a high tide results in a slight increase in the amount of water bailed. If this is the case, and it is probable enough, as the lode strikes seawards, and the rocks are decomposed, any attempt to sink deeper will be hampered by very heavy water. This is to be regretted, as the flake, when free from mica, is of very good type.

Four chains S., 30deg. E. from the shaft, another graphite zone is visible on the shore, striking N. and S., and having a width of several feet. This body is not decomposed, and consists of a highly garnetiferous gneiss, with much quartz and felspar, and contains strong flake of medium size, and a little mica.

A number of specimens broken from the outcrop near low-water mark yielded 6.5 per cent. of concentrate assaying 68.04 per cent. of carbon. The flake obtained is clean and strong, but the concentrate made contained both mica and a proportion of grit.

The coarse tailing was very free of flake, and the through 80 mesh rejections did not carry a large proportion of finely-divided flake.

The results are of importance in that the ores to be expected below the zone of oxidation in the Port Lincoln district will be gneissic in texture, and this sample shows that the flake in the solid ore should be strong and clean, and probably large enough for a large proportion to be recoverable.

Claim 10565.

This claim is situated on the coast immediately to the west of claim 10532 (Yarranyacka Syndicate).

A 10ft. pit, 20ft. above and half a chain from the sea, and 4ch. W.N.W. from the S.E. corner of the claim, exposes disseminated small flake graphite and some mica.

Similar pits, 1¾ch. and 2¾ch. to the E. show traces of flake in vertical strata. There is not sufficient flake visible, and the workings are too near the sea to justify further work at these points.

Claim 10568.

This claim adjoins 10532 on the N. A shaft had been sunk to 36ft., but the claim was under exemption, and the shaft was in disrepair, and was not descended.

Graphite was stated to have been first cut at about 16ft. in depth, below the "Recent" covering of the Pre-Cambrian rocks, and occurred in small veins dipping to the westward. A number of these veins were passed through.

The dump showed that the shaft passed through decomposed felspathic rock (gneiss), free of iron, and containing a little medium sized to small flake of good appearance. The dump was too low grade to sample, but the shaft has only tested a very small proportion of the ground, and crosscutting would be advisable. Water will probably be less troublesome here than nearer the coast, and if the results of crosscutting justified, the workings could, with suitable pumping appliances, be carried down below sea level.

Claim No. 10590, on Section 13m and 14d.

The road between these sections has exposed lateritic rubble, containing graphite flake and occasional stones of graphite schist, in the same zone as is covered by claims 10638-41. The width over which these surface indications are present is not less than 50yds.

A shaft has been sunk to 12ft., but has collapsed to 9ft. Some stones of semi-decomposed gneiss were present on the dump, probably from the bottom of the shaft, and contained flake of good appearance. A sample cut at 9ft. in depth consisted of slightly ferruginous clay containing lath-shaped flake. It yielded 3 per cent. of flake, assaying 54.8 per cent. of carbon. Under the microscope the concentrate was clean-looking flake, except for some coatings of iron, had practically no mica, and a little free grit. The quantity present and the appearance of the flake were improving rapidly in the few feet of sinking done, and this locality justifies further sinking, and the crosscutting of the formation in search of the best bands.

Claim 10591.

Situated three-quarters of a mile N. of Sleaford Bay.

A shaft has been sunk on the road between sections 14b and 14e to a depth of 26ft. (water level).

No work was being done, and an examination of the dump showed that the shaft had penetrated semi-decomposed gneissose rock carrying a little flake. The quantity was variable, some small specimens showing a good proportion of flake, but a sample of the better material on the dump only returned 4 per cent. assaying 41.3 per cent. carbon.

Under the microscope the flake is seen to be small, and a large proportion of the material consists of composite particles.

Here, again, a 26ft. shaft, without any crosscutting, can hardly be said to have exhausted the possibilities of a 40-acre claim, especially as flake is stated to occur on a low rise a little to the E. of the road, and on which no work has been done.

Claim 10634, Section 15.

This claim is one of an extensive group on the N.W. shore of Sleaford Mere. At a point about 500yds. W. of the Mere, and about 50yds. N. of the road from the Mere to Mikkera Station, a pit has been sunk to a depth of 4ft. in very hard ferruginous limestone, possibly travertine of superficial origin. A very little flake graphite is present scattered though the rock, but a sample over a width of 4 ft. yielded no concentrate worth assaying, only a few specks being visible under the microscope.

The outcrop is not promising, but it might be advisable to sink a few feet to determine whether the limestone is superficial material with a little flake caught up in it, and perhaps concealing a more important body of graphitic rock.

Claims 10638/41, Section 13m.

These claims are at the southern end of 10590, on a belt of lateritic rubble containing flake graphite, and are immediately west of the road bounding section 13m on the east.

A shaft had been sunk to a depth of 13ft. in a decomposed felspathic rock of schistose habit, probably gneiss. Flake was not very plentiful, and was, on the whole, somewhat small, but small, fairly rich bands containing flake of larger size were noted.

A sample cut along the bottom of the shaft yielded a concentrate, which, when examined under the microscope, contained so much mica mixed with the flake graphite, in addition to quartz and felspar granules, that it was not assayed. The flake present was bright Shoad stones containing flake may be seen for 150ft. to the westward, and 30ft. to the eastward of the shaft, but to the E. the flake in them is smaller than to the W. Thus out of a width of 180ft. only 6ft. has been seen below the surface, and that only at a depth of 13ft. Considering the appearance of the flake, further sinking and crosscutting in search of richer bands free from mica is justified, and, indeed, on a holding of ¾ mile along the graphite zone there is room not for one crosscut, but for several, to prove the value of the formation. It may be noted that on claim 10590, to the N. on the same formation, the shaft cut material containing only an inappreciable amount of mica, and giving promise of improvement in depth.

HUNDRED OF ULEY.

Mineral Claims: 10560, 10593, 10594, and 10595, on Section 2ae2.

A group of claims is held by Mr. Thomas Creer in section 2ae2, hundred of Uley, for graphite. These claims are Nos. 10560, 10593, 10594, and 10595, each of 40 acres.

Situated about 250ft. above sea level, they occupy the northern portion of a low plateau and part of the northern slope falling to a valley about 40ft. lower. The claims are about six miles from Port Lincoln Proper, but the present road is somewhat longer.

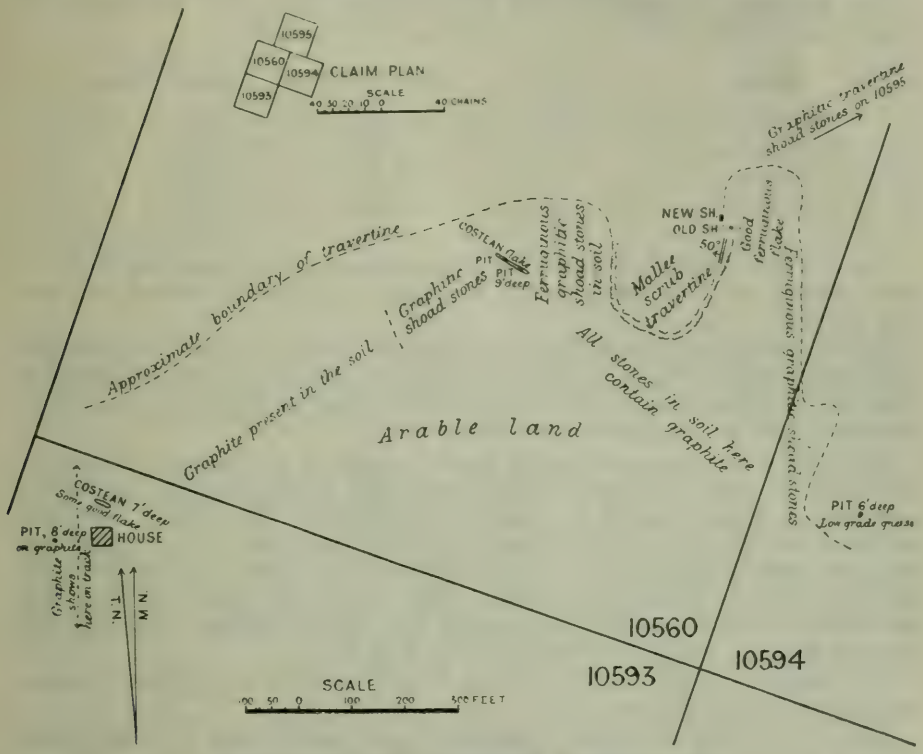
The principal workings are on claim 10560, and comprise two shafts to 26ft., with 30ft. of crosscutting, one or two minor pits, and a costean. The bulk of the surface indications are ferruginous stones carrying flake graphite, occurring plentifully through the ploughed land.

Commencing at the S.E. shaft, shoad stones of good quality as surface stones are abundant for a distance of 190ft. to the E.S.E., where a belt of travertine obscures the underlying rocks. This deposit was skirted for 460ft. to the S., the soil showing graphitic floaters; 110ft. E. a 6ft pit exposes gneissic rock with under 1 per cent. of flake of good quality.

Returning to the shaft, and proceeding W. by S., a patch of travertine, 215ft. wide, is crossed, of which the first 30ft. shows graphitic rocks incorporated with the travertine. After crossing soil containing shoad stones with flake for 215ft., a costean is reached, extending 75ft. to the S.E. A little flake is visible in this, and more where two pits have been sunk to greater depth. From this point graphite shoads were traced for 250ft. towards a settler's abandoned house to the S.W., and are understood to have been found as far as this house.

In a south-easterly direction from the costean, all shoad stones are graphitic until the first traverse is reached, thus showing that the patch of travertine lying to the N. between the shaft and the costean, is overlying graphite-bearing rock.

In the vicinity of the house above referred to, and which is situated near the N.W. corner of claim No. 10593, a 7ft. costean has been sunk 40ft. to the N. of the house, and shows some flake of good appearance. A pit, one chain W. of the house, sunk to a depth of 8ft., shows rapid improvement. At the depth of 8ft. the gangue was earthy, containing both flake and amorphous graphite. Iron is not prominent at the depth, and the flake assayed 76.4 per cent. carbon, 2.35 per cent. being recovered.



WORKINGS AND SURFACE INDICATIONS.
Claims 10560, 10593, and 10594.

Between this pit and the house, a N. and S. road shows ferruginous graphite shoad stones for a distance of 100yds.

To the N.E. of the main shaft, similar shoad stones may be seen on claim 10595, but little can be seen owing to the large development of travertine.

The attitude of the graphitic zone is obscure, the only definite dip seen being that of the richest zone in the shaft, which dips between 50deg and 60deg to the W.N.W. Such a strike would be conformable to that of the region, and if correct would give—from the eastern travertine to beyond the costean, a width of 800ft over which graphite stones are found, and if the workings near the house be included, the width would exceed 1,200ft.

It must not, however, be supposed that such widths as are suggested by the presence of shoad stones are all uniformly graphite bearing. The relatively small amount of work done here and elsewhere in the district all go to show that such big zones of graphite country are made up of zones varying in the amount of graphite present, some parts being practically barren, and others good quality.

Should, however, this strike be misleading, there is a width in a N. and S. direction of 300ft. at the S.W. or house end, and over 500ft. at the N.E. end. In any case the amount of ground to be proved is very large.

The first sample of ferruginous outcrop from this property yielded:—

On 30 mesh sieve, 5.75 per cent. of flake, assaying 51.55 per cent. carbon.
On 80 mesh sieve, 9.5 per cent. of flake, assaying 57.52 per cent. carbon.
Middlings, on 80 mesh sieve, 2.75 per cent. of flake, assaying 33.67 per cent. carbon.

As a result the work outlined above was carried out, and fresh water was cut at 26ft. in the shaft, and a crosscut was driven.

The following samples were cut by Mr. Creer from near the bottom of this crosscut, and tested by the Government Metallurgist:—

Sample.	Width. ft.	in.	Per cent of Flake.	Per cent. of Carbon in Flake.
1	2	0	8.1	41.4
2	7	0	13.3	40.4
3	7	0	8.7	58.3
4	2	6	17.7	71.5
5	4	0	15.5	42.8
6	2	0	9.2	35.2

No. 4 was re-treated, and yielded 12 per cent. of flake, assaying 88.7 per cent. carbon, which on being sent to London was valued in October at about £40 per ton.

The other samples, though benefited, did not respond so well, and did not yield flake of 80 per cent carbon. At the same time, it must be remembered that Nos. 1, 2, and 3 are still ferruginous, and that with greater depth they may be expected to improve, as No. 4 has done.

The writer on this occasion was unable to sample the crosscut, owing to the depth of water present, but an examination of the crosscut was made and from a comparison of the material standing in the crosscut with the samples sent in, there is no reason to doubt but that proper sampling methods were adopted. This examination by the writer, showed that the best material was in the west crosscut; that 9½ft. in the eastern crosscut was too poor to sample, and that the eastern face was improving; and that the dip was between 50deg. and 60deg. to the W.N.W.

The property amply justifies sinking to 50ft. or 60ft, and extensive crosscutting to the W.N.W. and E.SE.

As it is, the 2½ft. of material yielding 12 per cent. of 88.7 per cent. flake, is more than equal to a 12dwt. gold lode of similar size, and there is every prospect of those parts, at present too ferruginous to yield commercial flake, doing so at a greater depth.

From the appearance of the crosscut, and work done elsewhere in the district, it is probable that bands of richer and poorer material will be found to alternate, and that the problems to be solved by exploration will be:—

(1) The location of the best bands.
(2) The average yield as a whole.

On this information will be determined the scale and type of future operations; whether to work the rich bands by underground mining, or whether it will be possible to remove 20ft. to 40ft. of overburden, and work the deposit by open-cut methods.

It would be advisable to deepen the western shaft (8ft. by 4ft.) to between 50ft. and 60ft., at which depth it should intersect the rich band, and then crosscut both ways. Future exploratory work would depend on the result of this preliminary work. A pump will be required, and it would be advisable to so timber and secure the proposed workings as to keep them available for inspection, as in a body with such possibilities of great size there may be a call for check sampling should the question of exploitation on the largest scale be under consideration.

After these claims had been seen by the writer, a little superficial prospecting to the E. of the shafts has exposed a rich zone, believed to be about 12ft. in width.

Three small specimens sent in to the Department by the prospector from various depths down to 7ft. yielded:—

	Percentage of Flake Recovered.	Carbon content of Flake. Per cent.
1.	17.0	80.7
2.	19.2	73.7
3. at 7ft.	30.8	86.5

The sample from 7ft. in depth contained 66 per cent. of carbon prior to concentration.

The body is considerably lower grade as a whole, but a shaft sunk to 30ft. has cut a high-grade graphitic band, samples from which yielded 17.0 per cent. and 15.5 per cent. of flake, assaying 86.0 per cent. and 80.9 per cent. of carbon. (7/3/18.)

HUNDRED OF LINCOLN.

Claims 10696-9, Section 116s.

A shaft has been sunk on this group of claims, to a depth of 19½ft., in much decomposed graphite schist and gneiss. The dip appears to be to the S.E., as a barren zone is visible in the N.W. corner of the shaft at the bottom. The improvement in the quantity of flake is visible in descending the shaft.

A sample cut round the bottom of the shaft yielded 2½ per cent. of concentrate assaying 34.0 per cent. of carbon.

Under the microscope this concentrate showed much composite quartz and flake, some grit, and a trace of mica with the flake carbon.

The yield and grade are low, but better-grade material occurs in seams and patches. Materials of this class previously sent in for examination to the Department of Mines from a depth of 16ft. were:—

(1) "Clay" or decomposed rock yielding 7.2 per cent. of flake assaying 83.8 per cent. of carbon.

(2) "Stone," 12.2 per cent. of flake, assaying 80 per cent. of carbon.

These results indicate that commercial flake can be extracted from some of the stone, and with a zone of the apparent size of this one, deeper sinking and crosscutting in search of richer bodies than that exposed in the shaft is clearly justified. The work done elsewhere shows that the graphite formations are made up of zones of variable graphite content. Here the graphitic zone is much concealed by travertine limestone, but is apparently of considerable size, and the shaft cannot be said to have been prospected more than 6ft. of its width, and no other work has been done.

HUNDRED OF WANILLA.

Claims on Section 2n.

Two groups of claims have been pegged upon this section.

The western group, of four claims, a few hundred yards east of the Port Lincoln-Cummins railway, includes:—

Claims 10596 and 10598.

On these a trench has exposed a zone, apparently about 2ft. wide, containing flake graphite in decomposed and clayey rock. The strike is N. and S., and the country rock consists of gneiss, in some places approaching pegmatite in habit, and in others mica schist.

A sample taken from this band yielded 4.5 per cent. of flake, assaying 35.3 per cent. of carbon.

A little mica was noted in the sample, but only a trace was seen in the concentrate, which contained a fair amount of composite particles. Some of the flake was coated with iron impurities when microscopically examined.

Merchant's Claim.

A claim adjoining 10598 on the N.W. has not been registered. A pit 3ft. deep exposes small flake scattered through a semi-decomposed felspathic rock.

A sample yielded 10.0 per cent. of concentrate assaying 21.5 per cent. of carbon. Under the microscope the flake in the concentrate is seen to be small and clean, but much quartz and quartz-graphite intimately associated were visible. As far as may be seen, the body is small.

Claims 10597, 10658, and 10659.

These claims lie about a mile to the eastward of 10596 and 10598, and are on a N.S. exposure of much decomposed graphitic schist. An exception to this decomposition is the presence of a number of blocks of hard, dark, bluish-grey unaltered schist containing graphite of amorphous habit. These blocks are not *in situ,* but lie along a N.S. line, and can only be derived from the breaking down of a narrow hard band that has resisted decomposition. A sample taken from a number of these blocks carried no flake, yielding a granular product, which, under the microscope, was seen to consist of quartz containing very finely divided, and therefore unrecoverable, graphite. From the type of rock, it is most improbable that any alteration will take place in depth, and further work in search of this body, which carries 10.4 per cent. of carbon, is not justified.

Near the northern end of this line of stones, and a little to the W., a 3ft. pit has been sunk in graphitic clay, containing 9.8 per cent. of carbon, and derived from the decomposition of a graphitic schist. A sample from the bottom yielded a granular product resembling that from the hard rock, but with the graphite even more finely divided. A few yards to the S. a 6ft. auger hole penetrates similar material carrying 8.2 per cent. of very finely divided carbon. The product made from this was identical in appearance with that from the two other samples. This group of claims is not worthy of further attention.

HUNDRED OF LOUTH.

Section 308.

An outcrop of limonite and flake graphite of promising appearance as a surface showing was seen on section 308, Louth, 2ch. to the eastward of the main Lincoln-Koppio road. It has a width of 20ft. to 30ft., and the surface indications are such as to justify the sinking of a prospecting shaft and crosscutting the deposit.

HUNDRED OF KOPPIO.

Section 35.

(*Vide* Review 26, p. 58.)

This section is alienated from the Crown, and two claims have been taken up under arrangement with the owner of the mineral rights. Two men were at work at the time of inspection.

A cut has been made into the hillside for 45ft. wholly in graphitic schist, but the maximum depth does not exceed 7ft. At the end of this cut a shaft has been sunk to 13½ft. from surface.

NEW OR NORTH SHAFT, GRAPHITE MINE (CLAIM 10560), HUNDRED OF ULEY.

GRAPHITE MINE, SECTION 35, HUNDRED OF KOPPIO.

To face p. 62.]

The graphite is present as flake, a fair quantity being still very tender and too brittle to save, and a good deal is amorphous or very finely divided. Some iron is present, giving the schist a brownish tinge. Magnesite is present as nodules in the schist, and a few veins of quartz are visible. The schist dips 60deg. E.S.E.

A sample taken from both sides of the shaft at 12ft. in depth, over a width of 6ft., yielded 8 per cent. assaying 47.4 per cent. carbon, and another from a sinkhole at 13½ft. yielded 23½ per cent. assaying 37.3 per cent. carbon.

Under the microscope this last concentrate proved to be very ferruginous, but only contained an occasional speck of mica and a little grit.

The result of the samples and the consistent increase in the amount of concentrate recovered, from the original sample taken at a depth of 5ft., which yielded 2.3 per cent. of flake assaying 42 per cent. carbon, justify deeper sinking and crosscutting in this very large body.

It is probable that finer grinding of the product from 12ft. and 13½ft. would result in a decrease in the percentage of flake recovered and an increase in its grade.

The presence of tender, and therefore irrecoverable, flake in the last samples taken makes it reasonable to suppose that, with greater depth, the flake will become stronger, and that a greater proportion will be recoverable.

Since the above was written, samples have been sent in to the Department of Mines from 18ft. and 28ft. They show a progressive decrease in the amount of iron, and an increase in the percentage of recoverable flake and in its quality.

The sample from 18ft. yielded 11.5 per cent. of flake assaying 67.9 per cent. of carbon, and the sample from 28ft. 9.00 per cent. of flake assaying 82.4 per cent. of carbon.

Owing to the dip of the formation, these various samples from a vertical shaft represent different portions of the formation, and the quantity of concentrate recovered is therefore not strictly comparable. There is still room for deeper sinking, as the iron, though diminishing, has not yet disappeared, and rendered the preparation of the high-grade concentrate rather more difficult than in an iron-free ore.

The prospects of this deposit are good, and it should be crosscut at a depth of 40ft. to 50ft. to determine the location of the best portions, and to develop a tonnage of ore.

Section 129.

The mineral rights of this section have been alienated from the Crown, but the lode was prospected under an agreement with the owner of the freehold. It was previously described on p. 59, Review 26.

At the northern end, on the spot where a former sample yielded 1.93 per cent. of concentrate assaying 44.3 per cent. of carbon, a shaft has been sunk to a depth of 27½ft., and a crosscut driven 16ft. to E. 30deg. S. The actual depth from the surface is not more than 23ft., as the shaft is on the top of a bold outcrop.

The main body exposed is 10½ft. wide, and is soft decomposed schist, free from iron, containing much small flake, some amorphous graphite, and a considerable amount of finely divided mica.

The following samples were taken from W. to E. at the bottom:—

Locality.	Per Cent. of Flake Recovered.	Per Cent. of Carbon in Flake.
0ft. — 4½ft.	7.5	71.3
4½ft. — 7½ft.	16.0	44.3
7½ft. — 10½ft.	16.5	28.9

Mica is the chief impurity in the 71.3 per cent. concentrate, and the flake is small and thick. The last two contain much mica, composite particles, and some grit.

From 10½ft. to 18ft. the crosscut exposed decomposed felspathised schist, with one 12in. band of graphite schist, which, on sampling yielded practically no flake. The remainder of the crosscut is in barren schist. The W. side of the shaft shows low-grade material only, but no wall has yet been cut on this side.

On the S. side of the hill, which this lode traverses, a 10ft. pit has been sunk in ferruginous graphite schist, 20ft. above the level of a small creek. A good deal of very fine-grained flake is present, but not much of it is large enough to be caught on an 80 mesh sieve. Some white mica is also present.

A sample from the bottom of the pit yielded 3½ per cent. of flake assaying 41.1 per cent. carbon.

The concentrate contains a good deal of composite material and some mica, and the flake is small and thick.

To the S.S.W. of this pit ferruginous graphite stones were seen for about 300yds., and are associated with magnesite.

One sample from the north shaft is almost up to commercial grade (80 per cent. carbon), but the mica is not very likely to diminish in depth, and it would probably be preferable to prospect along the graphite zone for ore less contaminated by mica, rather than to sink the shaft much farther.

HUNDRED OF HUTCHISON.

Section 27.

(*Vide* Review No. 26, page 53.)

Since this locality was last seen, the shaft has been deepened to 36ft., or 8ft. below the drive. The ground has become harder, and a dip of 60deg. to the S.E. is now recognisable. The graphite schist has passed out of the shaft at 33ft. in depth, and is ferruginous. A sample from this where last seen yielded no recoverable flake.

The bottom of the shaft exposes very ferruginous schist containing only a little very small flake, and is much harder than the graphitic schist seen at 30ft.

A sample from the S. end at the bottom yielded no recoverable flake, but it must be remembered that both these samples are not from the lode, which is now to the south-eastward of the shaft, and should it be desired to prospect it, it will have to be crosscut for at a greater depth.

Mr. H. P. Herbert, of the Morgan Crucible Co., in writing to the Department of Mines, stated that he had seen a large number of outcrops of this class, and in consequence advised that not much money should be spent upon this type of deposit.

Under these circumstances, it might be advisable for the syndicate controlling this property to transfer its activities to a locality of greater promise.

HUNDRED OF MILTALIE.

Sections 51, 48, 43N, 43S, and 40.

The mineral rights are alienated from the Crown, except in the case of section 40.

On the northern section (Bartel's), No. 51, a prominent hill shows two extensive bodies of graphitic felspathised schist, separated by a belt of quartzite.

The schist is slightly decomposed, but not sufficiently so to render it probable that there would be any marked change in depth.

The body to the W. of the quartzite shows amorphous graphite scattered through the schist. A sample taken from various places on this outcrop showed no flake, but contained 16.5 per cent. of carbon so finely divided as to be classed as amorphous.

The body to the E. of the quartzite has a bold dark outcrop of considerable width. A sample taken from this outcrop contained 13.2 per cent. of carbon, but yielded no flake.

A sample from this property submitted to the Department of Mines, and reported on (November 2nd, 1917), showed a similar absence of flake, and the writer expressed the opinion that not much improvement was to be expected with depth, and that further work on the deposit could only be defined as prospecting, rather than as the proving of a known deposit of flake graphite.

This opinion has been confirmed by an inspection of the body, which shows no promise of yielding flake in depth, and flake does not appear to have yet been discovered except on section 40 to the south.

On section 40 a limekiln sunk to a depth of 8ft. at a point whence the above body of amorphous graphite bears N. 22deg. E., and the Franklin Harbor Mine bears N. 30deg. W., exposes 3ft. of graphitic schist underlying 50deg. to E.S.E. Some flake graphite was visible in the schist, and the western 18in. yielded 4.5 per cent. of flake assaying 35.3 per cent. carbon. The eastern half yielded 4.0 per cent., assaying 43.2 per cent.

The flake in both these samples is bright and small, but much ironstained. Composite particles and grit are present in considerable amount.

This body has improved in the 8ft. sunk, and though apparently small, may justify further sinking.

The type of graphite and the physical character of the gangue is quite distinct from that to the N.N.E. (22-12-17.)

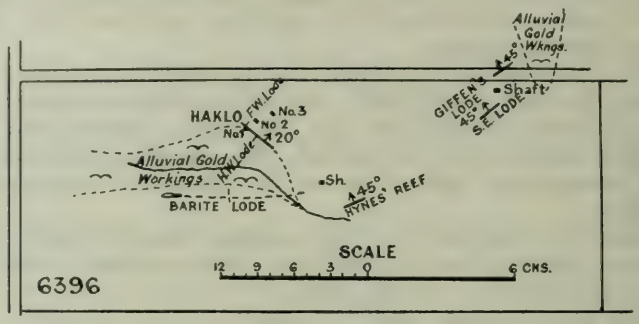
REPORT ON THE HAKLO MINE, SECTION 6396, HUNDRED OF TALUNGA.

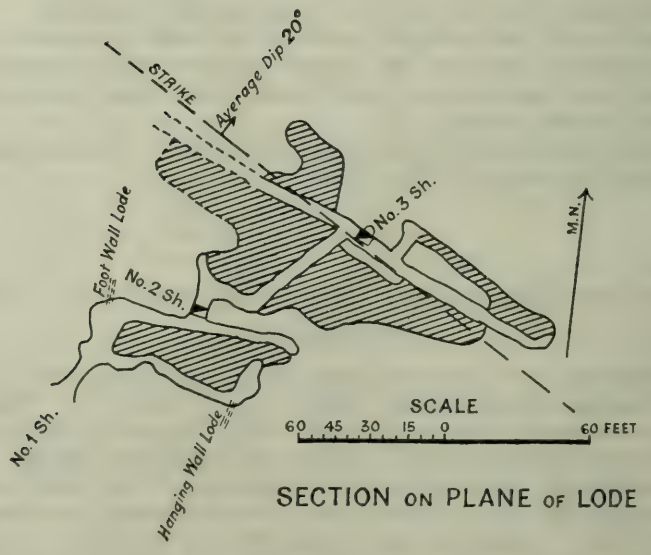
The Haklo Mine is opened on a lode of quartz, limonite, and decomposed micaceous schist dipping about 20deg. to N. 30deg. E. The enclosing micaceous wall rock is sheeted parallel to the lode, and is decomposed, and by reason of its softness and the sheeting has facilitated stoping. Evidence of movement in the plane of the lode is afforded by two quartz bodies. The first one, about 30ft. down the underlie, is in the footwall, and does not cross the Haklo lode. It had an approximate N. and S. strike. A parcel of 7 tons from this gave a return of £5 7s. 10d. The other, about 60ft. to the eastward, is in the hanging wall only, and strikes N. 20deg. E., and dips 40deg. to W.N.W. It consists of iron-stained quartz about a foot wide, and is low grade.

The mine is entered by an irregular underlie, and two drives have been driven. These drives pitch to the eastward in conformity with the pitch of the thicker portions of the lode. Vertical shafts, the deeper 70ft., are sunk to each level.

The lode, as seen in the workings, varies in width from ½in. to 6in., but as the wider portions have been stoped, the average width of the lode as mined was arrived at by calculation. The lode has yielded 291.6 tons, worth

£709 8s. 11d. In mining this ore the lode has been removed over an area of 8,480 sq. ft., which, at 14 cub. ft. to the ton, gives the thickness of the stoped portion as 6in. The average yield was £2 8s. 7d. per ton. The lode is very regular, the maximum development being understood to be about 9in. in an area of 180ft. by 140ft.





HAKLO MINE

SECTION 6396 HD. TALUNGA

The small size of the ore body and the amount of ground that had to be broken, owing to the flatness of the lode, has rendered the working of the mine unprofitable.

Seven chains E. 28deg. S. a 20ft. shaft and short crosscut exposed a vein of stone, about 2in. wide and of good grade, that is assumed to be identical with the Haklo lode.

Below the projected line of outcrop a good deal of alluvial gold has been won in the past. None has been won uphill from this outcrop, and there does not appear to be any reason to assume that the kaolin, worked higher up the hill, and which is formed by the decomposition of slate, has been responsible for the shedding of this alluvial.

The alluvial was found, not only in the gully, but for some little distance up a gentle slope to near the barytes lode, a body striking E. and W. and dipping N., and which has been worked for barytes for some 2ch. along the outcrop, and to a depth of 50ft. Barytes may be traced eastward to near the 20ft. shaft above referred to. Gold is not known to have been present in the barytes, though a little barytes is known to occur associated with gold in the Deloraine Mine.

Immediately S. of the easternmost exposure of barytes there is a narrow gutter of alluvial crossing the line of the barytes lode, and this gutter may have carried the gold from a small quartz body, known as Hyne's Reef, from which a crushing of 6dwts. per ton is stated to have been obtained.

Taking into consideration the low dip of the Haklo Lode, the position of Hyne's Reef, and the probability of a variation in the position of the bottom of the gully as erosion of the country proceeded, it appears as if these two lodes were quite capable of yielding the alluvial gold found below them. At the same time, there may be other auriferous bodies not known, and possibly of small size, that by the erosion of their outcrops contributed alluvial gold. Yet this is conjectural, while the outstanding fact is that the Haklo and Hyne's Reef could, aided by a slight variation in the position of the bed of the gully, have yielded the known alluvial gold.

Twenty chains to the E.N.E. is the Young Bullfinch Shaft (formerly Blumberg Gold Mines), with, on the N.W., Giffen's Lode, and to the S.E. a second lode. Both dip to the N.W. and have given good returns. Alluvial gold derived from these lodes has been worked in the gully to the east.

It has been suggested that the Haklo Lode, striking E. 30deg. S. and dipping 30deg. to the N.N.E., may have swung round, and be represented by Giffen's or the lode to the S.E., which strike N.E. and dip 45deg. N.W., in which case there would be a possibility of a second lode near the Haklo.

It seems more probable, however, that the Haklo is a lode younger than the N.N.E. to N.E. series represented by the cross lode in the Haklo workings, Hyne's, Giffen's, and the S.E. lodes.

Further prospecting in the Haklo would probably be best carried on by extending the bottom drive, preferably the west drive, as it would penetrate fresh ground, and apparently has not yet reached the intersection of the Haklo Lode with that in the footwall. Unfortunately this drive had been filled with waste, and the face could not be seen. The eastern drive may be expected to cut the bulge of stone worked above No. 1 level before new ground is penetrated.

It would also be advisable to try and locate the hanging wall cross lode at the bottom level, and rise a short distance upon it to see if it carried values at this point. It may be expected in the roof 50ft. to 60ft. W. of No. 3 shaft. (14-12-17.)

REPORTS

BY

The Chief Inspector of Mines (L. J. Winton, B.E.).

BUTLER'S MANGANESE SHOW, OODLA WIRRA MINERAL CLAIM, No. 10628, SECTION 179, HUNDRED OF PARNAROO, ABOUT NINE MILES SOUTH-EAST OF OODLA WIRRA.

An ironstone outcrop occurs here in a belt of limestone, which on the N.W. side is coarsely crystalline, and on the S.E. side is more finely crystalline and dolomitic.

The outcrop of the lode, which strikes N.E. and S.W. can be traced for a couple of miles, and in places shows the presence of manganese to a greater or less extent. No definite idea of the width of the outcrop could be formed as no trenching or crosscutting had been done, but possibly it would be 15ft. to 20ft. wide in places. The underlie was also uncertain, but as far as could be judged the formation appeared to have a N.W. dip.

Very little work had been done, the only exposure of the formation being in a small 6ft. x 4ft. shaft, 12ft. deep.

Here about 6ft. of manganese ore was showing, and two samples were taken, one from the end, where the manganese was in solid formation, and the other from the side where the ore was of a loose and earthy nature. These samples were assayed with the following results:—

	No. 1. Per cent.	No. 2. Per cent.
Insoluble (silica, &c.)	33.40	33.40
Manganese dioxide	53.56	53.74
Manganous oxide	2.27	2.13
Ferric oxide	3.87	2.90
Phosphoric anhydride	0.32	0.31
Total manganese	35.62	35.62
Total iron	2.71	2.03
Phosphorus	0.14	0.13
Sulphur	0.15	0.13

The total amount of manganese is thus shown to be 35.62 per cent., both samples agreeing very closely.

Third grade ore should contain 40 per cent. to 47 per cent. of manganese, so unfortunately the ore as disclosed at this spot must be classed as lower than third grade, and cannot therefore be regarded as of economic importance

Other parts of the formation show the presence of manganese, but no work has been done to open it up elsewhere.

To test any portion of the formation where manganese occurs a trench could be cut across a few feet deep, and if any promising indication were disclosed a prospecting shaft could be sunk on it.

A sample was taken from some shallow pits on the southern end of the formation, not on the claim. On assay it proved to contain gold, nil; silver, nil; manganese, nil; iron, 53.5 per cent.

With regard to the sale of manganese ores the following figures will be of interest:—

For electrical purposes the highest quality, containing about 85 per cent. of manganese dioxide is required.

For other purposes lower grade ore can be used, but the lowest limit is 40 per cent. to 45 per cent. metallic manganese; ore less than this value not being saleable, as a rule.

In England 50 per cent. metal is the general specification, though as low as 45 per cent. metal can be taken.

A penalty of 7d. per ton is imposed for every unit of silica above 8 per cent.

The average price c.i.f. British ports, of manganese ores containing 48 per cent. metal during the years 1912-13-14, was 10½d. per unit, or £2 2s. per ton. The price has risen during the war period till in 1917 the London quotation c.i.f. British ports is 2s. 10d. per unit, on the basis of 60 per cent. metal, or £8 10s. per ton of ores carrying 60 per cent. of metallic manganese.

In America, in May, 1917, the price was £3 19s. 2d. per ton of 45 per cent. manganese, or 1s. 9d. per unit. A deduction of 2s. 8½d. per ton is made for each unit below 45 per cent.

Silica is permissible up to 8 per cent., and is penalized up to 15 per cent. Over 15 per cent. renders the ore unsaleable. (7-8-17.)

PARABARANA COPPER MINE.

(*Vide* Review No. 9 and Mining Record, p. 100.)

This property comprises four mineral claims, Nos. 10401, 10402, 10463, and 10464, situated on the eastern side of the northern extremity of the Flinders Range

The distance by road from Copley (Leigh Creek) Railway Station is 120 miles, and the railway station and township of Farina is 88 miles in a direct line to the west.

There are several lode formations showing copper minerals, situated in the rough, hilly country where the range rises from the plains which extend from Lake Frome, the workings being about half a mile in a south-easterly direction from Parabarana Hill.

At the place known as the "quarry" there is a small open cutting on a formation which shows copper minerals; a little W. of S. from this are some costeans in which traces of copper were found, and 14½ chains W. of S. from the "quarry" is the deepest shaft, known as Lee Shaft.

This has been sunk to a depth of 200ft. on the underlie of the lode, which here dips W.N.W. at an angle of 25deg.

The upper portion of the shaft has been sunk in the footwall country, but in the lower portion the lode 10in. to 14in. wide, comes into the shaft, and a little stoping has been carried on at three points near the bottom of the shaft, which is still in lode formation.

Four and a half chains farther to the S.W. there is another costean, and a shaft known as Holmes', from which some ore has been taken.

About 13 chains W. of this, some distance up the slope of another hill, an adit has been put in for 90ft. on a lode formation, and from the end of the adit a winze has been sunk for a depth of 18ft. on the lode, which is here about 6in. wide, and dips N.W. at an angle of 50deg. A drive has been started from the bottom of the winze on the lode formation.

The workings from the "quarry" to Holmes' Shaft are on the same general strike, and appear to be on the same formation, striking N.E. and S.W.

At a place known as Green Hill, a little to the N., there is also an outcrop which shows the presence of copper minerals. The presence of a little manganese was noted in places. To the S. of the claims there occurs an outlier of desert sandstone of peculiar blocky structure, and the surface rocks in

general are characterised by a superficial silicification which gives them a polished jaspery appearance.

The copper minerals occur in mineralized pegmatitic intrusions filling fissures in the country slates.

Felspar is here the predominant mineral, accompanied by a ferruginous calcareous material, which shows calcite and siderite, or carbonate of iron in places.

In other places the siderite is decomposed to limonite, giving rise to a gossan formation.

The copper minerals found are chiefly cuprite or red oxide of copper, and chalcocite or grey ore. With these are found a little atacamite, or dark-green oxy-chloride, malachite, or green carbonate and chrysocolla or silicate of copper, pale bluish-green in color. No chalcopyrite was seen.

The occurrence of these minerals is patchy—as impregnations in the formation—or in the form of small slugs and boulders, which, when broken, show the presence of copper, and between the occurrences of minerals barren formation of more or less extent intervenes.

At one time a concentrating mill was erected here, but after doing comparatively little work, was removed.

The working of a property such as this is fraught with many difficulties.

Situated so far from a railroad, and at such a distance from a smelting centre, the ore, if sent to such, has to bear heavy transport charges, the consequence of which is that only high-grade ore will show any profit, in this case probably nothing under 10 per cent. will pay expenses, with copper at £100 per ton.

As the ore occurs in patches and impregnations in the lode, hand dressing and picking have to be resorted to, and a good deal of ground has to be broken for the production of a small quantity of ore.

Oxidised ore, such as this, is not really suited for concentration, as the tailing loss is very high, nor in this case is it suited for a leaching process, as much of the value is contained in cuprite which does not leach well, and the gangue contains a considerable amount of ferruginous and calcareous material, which would entail a large consumption of acid. (26-11-17.)

KANMANTOO COPPER MINE.

(*Vide* Mining Record pp. 13, 66, Reviews Nos. 8, 17, 18, 22.)

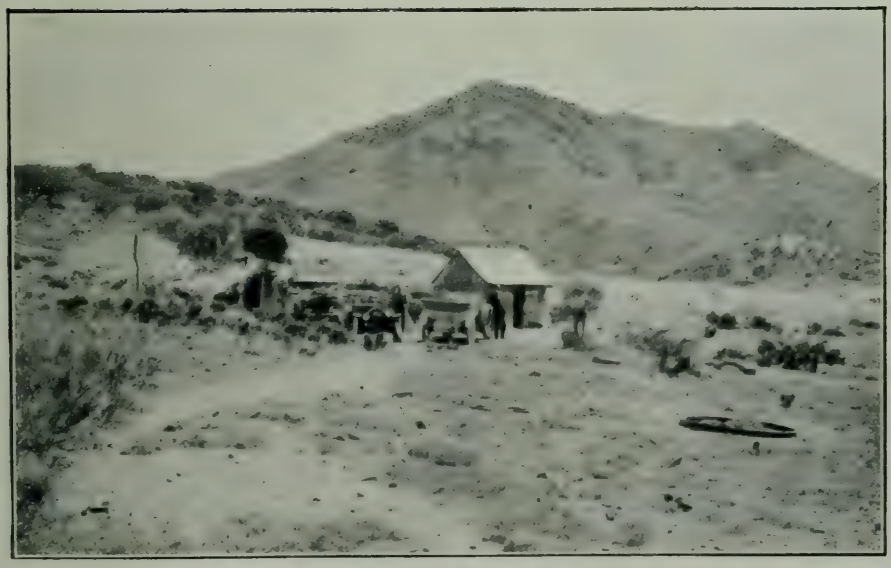
On December 5th, 6th, and 7th, an inspection was made of this property. It is situated on private property owned by the South Australian Company, about 43 miles S.E. of Adelaide and about three miles by road N.W. of Callington.

The mine workings are on the eastern side of some rounded hills of low elevation, about 140ft. above the road level, the West Kanmantoo Mine being on the western slope of the same hills. The Paringa Mine is on the western side of the southern end of the same range of hills, about 30ch. to the S. of the Kanmantoo.

The working of this mine dates from about 1846, when the ore was sent to England; but later on a reverberatory smelting works was established and the ore was smelted.

The mine was originally worked by the S.A. Company, and later on was leased to various individuals, a considerable amount of copper being obtained altogether. This ore, after the local smelting works stopped, was hand picked and dressed, and sent probably to Wallaroo or the E. and A. Company. Traces of chalcopyrite are to be seen about some of the workings, but probably the bulk of the tonnage obtained consisted of the richer

PARABARANA COPPER MINE, ADIT WORKINGS.



PARABARANA COPPER MINE, FROM THE EAST.

To face p. 70.]

secondary ores, carbonates, oxides, grey ore, &c., and, in all probability, where the supply of this class of ore was exhausted in depth, and the less valuable unaltered pyritic ore was met with, operations were stopped, and a fresh source of supply of the richer minerals was sought for.

The consequence of this leasing or tribute work, as far as can be ascertained, is that a large amount of comparatively shallow work has been done, and the rich ores extracted, with probably no commensurate amount of developmental work, and probably no attempt made to utilize the lower-grade primary ore which exists, though of what value and in what quantities it is impossible to say, as none of the deeper workings were accessible for inspection.

The workings extend, though not continuously, in a general N. and S. direction, over a distance of about 44ch., from the Wheal Mary workings at the N. end to the southern end of the Kangaroo and Spitfire workings, and from E. to W. from the Boundary Shaft to the Emily workings, various lodes have been worked over an extent of 10ch.

At the northern end the Wheal Mary workings are not very extensive on the surface, and consist of some open cuttings and a couple of small shafts on the southern end of these cuttings, from which some ore appears to have been obtained.

Going S. from here there is a gap of 13ch. until some cuttings are seen near the Emily workings, and a little farther on are the Roper and Boundary workings.

The Emily Shaft was full of water, but is said to have been stoped into a large chamber a little distance below the surface. Close to it is the Downright Shaft, said to be connected to the Emily Shaft by a crosscut at the 60ft. level. A little N. of Emily Shaft a quartz outcrop can be traced for about 3½ch. striking N. 15deg. E. South and a little W. of Emily Shaft is a line of workings from which ore has evidently been stoped out.

East of this, about 5ch. away, are the Roper workings, consisting of shafts and cuttings, one of which is about 2½ch. in length, from which a considerable amount of ore has been apparently extracted.

An adit level has been put in here, but having been dammed up for the recovery of copper from the water, could not be inspected.

A little to the N.E. of these workings are a shaft and some excavations on what is known as the Boundary lode, the general direction of the workings being E. and W. The dumps here showed a considerable amount of pyrite, with some chalcopyrite, associated with quartz.

Six chains S. is a large cutting, known as the "Quarry," 3ch. in length, from which a considerable amount of ore was said to have been obtained, the strike of the excavation being S. 40deg. W.

The Kangaroo Shaft and the accompanying workings are situated at a distance of 6½ch. S. of the Quarry.

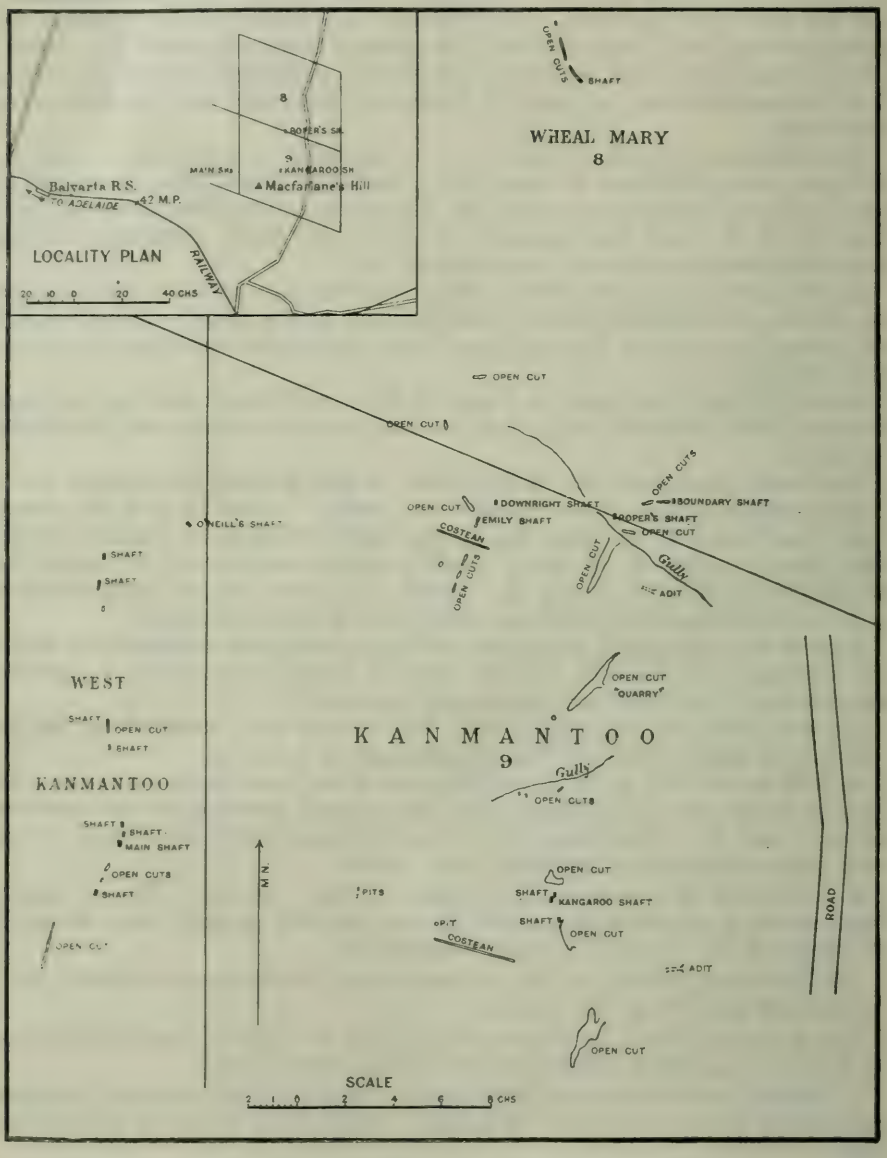
The Kangaroo Shaft itself has caved in, and a couple of small shafts close to it were unprovided with any means of descent or ascent.

A little S. of the shaft is a large open cutting said to be on the Kangaroo lode, while to the N.E. there is another cutting said to be on the Spitfire lode.

Two and a half chains farther to the S.E. is another large open cut, about 2½ch. in length, and farther S. some other surface workings extend for some distance. Six chains E.S.E. from the Kangaroo Shaft is the entrance of another adit, driven into the hill at the lowest level.

This adit at the entrance has a bearing of N. 70deg. W., and is said to have a total length of 450ft., and to have cut the Kangaroo and Spitfire

lodes, which were driven on N. and S., and the lodes stoped up to the surface in places. As, however, this level was also dammed up in connection with the extraction of copper from the mine water which flows through it, no inspection of the underground workings could be made, and no reliable information as to the lodes could be obtained.



This adit traverses a large rounded hill, about 140ft. in height, the top of which shows an ironstone formation, W. of the Kangaroo Shaft.

A long trench has been cut near the top of the hill, and a small pit sunk in this formation. From the evidence disclosed, however, it would appear that this ironstone is not the outcropping of a lode formation, but a superficial lateritic formation derived from the underlying schist. The schists

here carry a profusion of andalusite crystals, showing as small inclusions, and in the pit traces of these crystals can be seen in the ferruginous formation close to the surface, and becoming more defined with depth, tending to show that the iron capping is merely due to alteration of the schists.

Some small pits sunk near a gully on the northern fall of the hill show traces of copper minerals, but other than this there is very little work done W. of the Kangaroo Shaft, and not much trace of copper.

The workings of the Kanmantoo West lie on the western slopes of the same hills as the Kanmantoo.

Eighteen chains W. of the Kangaroo Shaft is the old mine shaft of West Kanmantoo, now caved in, with some smaller shafts and cuttings extending 2½ch. S.W., and a series of small workings extending N. for 12ch. in length. Five chains S.W. of the old main shaft is a quartz outcrop striking N. 15deg. E., which has an open cut on the N. end about 2ch. in length. About 17ch. to the S.W., off the Kanmantoo property, there is a shaft and workings, from which some copper ore, oxides, and sulphides is being obtained, and about 30ch. S. is the Paringa Mine, now idle.

None of the Kanmantoo West underground workings were available for inspection.

The country in which these mineral deposits occur is a broad belt of micaceous schist, carrying a considerable amount of garnet in places, and everywhere characterized by the presence of an abundance of andalusite crystals. These crystals resist weathering better than the schist, and appear as small nodules in more or less relief on the surface of the rock, as well as through it, and where the rock has completely weathered away, form a kind of gravel. The general strike of the country is N. 10-15deg. E., and the dip is about 80deg. to the E., at the Kanmantoo property.

The schist in many places has been penetrated by quartz veins, most of which strike and dip with the country. Numbers of small seams, however, traverse the country irregularly, and a larger and more important one, known as the Boundary Lode, appears to have an E.W. direction. The occurrence of the ore is probably connected with these quartz veins, though in many places impregnations of copper minerals can be seen in the schist, and at other places quartz outcrops can be seen which do not appear to carry any mineral.

There are said to be several N.S. lodes, the Emily, Roper, Kangaroo, and Spitfire, and the boundary lode, running E.W.

In some of the larger workings it would seem that fissuring of the schist had been irregular, and had given rise to a number of veins of various sizes which together with the associated schist were more or less impregnated with copper minerals, and were stoped out as a whole, thus giving rise to the large excavations.

On the hill on which the Kangaroo Shaft is situated, there appear to be only two lines of workings, the Kangaroo and Spitfire. The hill itself does not show any prominent outcrops W. of this, and very little workings other than the trench and pit on the lateritic capping, and a few small pits, some of which to the N. show traces of copper. Traces of small quartz seams can be seen in places, but whether any lodes occur W. of the Kangaroo Shaft, between it and the West Kanmantoo, has not yet been determined.

The fact that the prolongation of the line of strike of lodes such as the Emily, passes through a hill some distance away, is not sufficient evidence that the lode itself continues, and will pass through that spot. It is generally advisable to establish the presence of the lode by means of some comparatively cheap surface work, costeaning, &c., before proceeding to more expensive methods of development and exploitation. It is to be regretted

that in examining a property like this, with a view to reporting on it, no attempt is made by the owners to facilitate the inspection of any of the underground workings that may present an opportunity for examination, as the evidence to be gathered by such an inspection is of the greatest value in forming conclusions on which to base a report.

In all probability most of the rich secondary ores have been extracted, and unless new sources of supply are discovered, the ore to be considered in the future is the sulphide ore, chalcopyrite. As this could not be seen anywhere *in situ*, no judgment could be formed as to its quantity and value, or the suitability of any method of treatment. (13-12-17.)

DIAMOND JUBILEE MINE.

(*Vide* Mining Record, p. 49, and Reviews Nos. 9, 13, 17, 19, 22.)

Mineral Claim 9278, situated about nine miles E. of Copley.

A considerable amount of work has been done on this property, but only to a shallow depth, as the deepest shaft is said to be 160ft.

The main workings consist of an adit level 300ft. long, which has been put in from the side of the hill to intersect one of the lode formations A drive extends along the lode for some distance, and stoping has been carried to within about 30ft. of the surface.

The adit bears S. 25deg. W., and shows no sign of any mineral until it intersects the lode.

From the drive a winze has been sunk to a depth of 23ft., at which level the lode has been driven on for some distance S.E.

The lode formation here strikes N. 60deg. W., and dips S.S.W., and consists of a gossan formation with a considerable amount of quartz.

Copper minerals occur in this formation in stringers and veins of small size up to 6in in width, consisting of malachite and atacamite, chalcocite, or glance, and cuprite or red oxide.

The occurrence of the minerals in small seams of course renders it necessary to pick and dress the ore as obtained in breaking down the lode. The country is a bleached and silicified slate, and quartz and ironstone breccia impregnated with malachite and atacamite show in the formation in places. A considerable amount of leaching appears to have taken place in parts of the lode, and possibly a certain amount of mineral has thus been removed and re-deposited at a lower level, probably about water level.

Chalcopyrite was seen in the dumps from two of the deepest shafts.

Two men were working at the time, extending the drive in a S.E. direction along the lode formation, and picking and dressing the ore obtained in the course of the work.

HOLMES'S BLOCK.

This claim forms part of the Elsie Adair Options, or Amalgamated Copper Syndicate, which holds three claims, 10468, 10469, 10470, mineral claim 10468 being known as Holmes's Block, situated about nine miles from Copley, and 1½ miles E. of Mount Coffin.

There is a series of shallow workings extending over some distance, in which copper minerals can be seen.

Bleached and decomposed clay slates are impregnated with green carbonate of copper. The deepest shaft is said to be 100ft. Some ore was being obtained from shallow workings about 42ft. deep.

The copper minerals are evenly distributed through the slates, so that there is no possibility of dressing or picking the ore to improve the grade, hence it must be considered as a low-grade ore.

MOUNTAIN OF LIGHT COPPER MINE. MAIN SHAFT AND PORTION OF WORKINGS.

NICHOL'S NOB COPPER MINE, LOOKING NORTH.

To face p. 75.]

From its nature it is not a good smelting ore, nor likely to be looked upon with favor by any smelting works, which would probably accept it only in small parcels.

Ordinary concentration would not be successful, and the most likely process of treatment would appear to be leaching. Experiments carried out by the Government Metallurgist show the suitability of the ore for leaching.

There is, however, a certain amount of arsenic in the ore which complicates the problem, as it is a very undesirable impurity, and some smelters refuse to treat ores containing arsenic.

As the Government Metallurgist points out, an abundant supply of water is necessary for leaching, and as water is not abundant in the locality, provision would have to be made for an adequate supply.

Before any extensive method of treatment were decided upon, the amount of ore and the average grade to be expected should be determined to greater or less extent by some systematic prospecting.

NIDDRIE.

Mineral lease 2288. This lease adjoins the old Mount Coffin Mine leases on the east. A small cut has been opened up, 22ft. x 13ft. x 10ft. deep which is entirely in copper-bearing clay slates. The copper occurs as malachite impregnated through the slates in thin streaks and stains parallel with the bedding. It is evenly distributed throughout the ore body, so that no hand picking or dressing is possible.

The slates strike E. and W., and dip S. at an angle of 70deg. Some parcels of ore have been sent to Wallaroo, but the ore is not a good smelting ore, and a leaching treatment would appear to be that most suited for it, if sufficient tonnage is proved, and a water supply can be assured.

The open cut is 22ft. in width across the formation, and wholly in it, with the copper-bearing formation still showing on both sides and ends.

MOUNTAIN OF LIGHT, ETC.

(*Vide* Mining Record, p. 129, and Reviews Nos. 8, 10, 13, 16, 17, 18.)

One and a half miles S.E. of Copley there are a number of old mining claims grouped together, the Mountain of Light, Cutaway, Wild Dog, Dolly St. Beatrice, Matheson's, Holmes's Claim, and O'Donnell's Claim.

The claims now held are 10341; 10407, part of Matheson's; 10502; 10507, comprising part of Mountain of Light and part of Cutaway; 10690, Holmes's Claim; and 10689.

No regular mining was in progress, but a little ore was being obtained by sorting over the old dumps, &c.

There is a considerable length of workings here along the line of lode, but apparently no work of consequence has been done below water level.

There is a good vertical shaft, with head gear, which connects with the workings at water level, and near this shaft is a dump showing pyrite.

This shaft is said to be sunk about 100ft. below water level, but to be in very bad order owing to the timbers shifting.

In places the lode has been stoped to the surface, and where the formation was seen it showed green oxidised ores of copper in seams and impregnations in a soft iron-stained and decomposed clay slate. The general strike is E. of N., and the dip is to the S., a dip of 60deg. being observed in one place.

The lode appeared to be about 4ft. wide, though said to be wider in places, but a lot of the workings were in a ruinous condition and could not be inspected.

No work has been done here below water level beyond crosscutting to the lode, which is here said to carry a lot of iron pyrites.

HOLMES'S CLAIM.

(*Vide* Mining Record, p. 130, and Review No. 10.)

This claim, M.C. 10619, is held at present, although no work was being done there at the time.

It is situated close to the Mountain of Light property. A good deal of open cutting work has been done on formations showing copper minerals, but mining has not been carried to any depth.

LESLIE'S WELL C.M.

(*Vide* Reviews Nos. 9, 25.)

M.C. 10290. Situated near Leslie's Well.

A considerable amount of shallow mining has been done here, on a formation of bleached and decomposed clay slates, which strikes E. and W. and dips N. at an angle of 60deg. This formation is penetrated by a number of seams of copper ore, varying from a fraction of an inch up to 9in. in width. These seams strike with the country sometimes, and sometimes across it, and carry cuprite, chalcocite, and malachite with some atacamite, the minerals being generally associated with quartz. Some small ferruginous seams are also seen, carrying copper, and cutting across the slates. The average width of the formation appears to be about 8ft., and all the work done has been by means of open cutting to a depth of 13ft.-15ft.

The waste obtained in getting the ore has been filled in again, so that little sign of the older workings remains. The ore is hand picked and dressed to between 20-26 per cent. copper, and dispatched to the smelters.

LYNDA COPPER MINE.

(*Vide* Mining Record, p. 77, and Review No. 9.)

Formerly known as "Mount Lyell," "Turnerton," "Mottrams," or "Lorna Doone." Situated three miles N. of E. from Leslie's Well.

No work has apparently been done here for a considerable time. In the past oxidised ores have been obtained from numerous open cuts, some of fair size, and from some shallow underground workings. At one place about half a mile N.W. from the concentration plant there is a large open cut and a vertical shaft sunk to water level. The country consists of iron-stained and silicified slates, outcropping in long parallel rows, and quartzite, the slates being bleached and decomposed in the mineralized area.

They strike E.W. and dip N. at an angle of 60deg., and in this respect, as well as in general appearance, are similar to the formation at Leslie's Well Mine, the minerals apparently occurring in irregular veins throughout the formation, which also shows a certain amount of quartz.

A concentration mill was once in operation here, the plant being still on the property, and, judging from the large tonnage of tailing, must have treated a considerable quantity of ore. As usual, however, in attempting to concentrate oxidised ores, the copper minerals that can be seen in the tailing show that the process was a wasteful one. Ore from the Belliak Mine is said to have been carted here also for treatment.

Near Mount Lyndhurst Head Station, the spot where a small nugget of gold was found, was visited.

The position was a slight depression between two low rises, the country consisting of flaggy iron-stained and silicified slates striking E.S.E. and dipping S. at an angle of 75deg., and carrying a little quartz and calcite.

The local belief was that the gold had been lost many years ago by an old prospector, and probably this is correct, as no other trace of gold has been found since.

NICHOL'S NOB COPPER MINE.

(*Vide* Mining Record, p. 28, and Reviews Nos. 9, 13, 19, 22, 24.)

Formerly known as the Benalack Mine. Comprises M.L. 1732 and M.C. 10287 and 10288, situated on some small hills about a mile to the eastward of Nichol's Nob.

A considerable amount of work has been done here on three formations approximately parallel, several shafts having been sunk to various depths and a large amount of open cutting done along the outcrop of the formations.

Fels' Shaft, on M.L. 1732, has been sunk to a depth of 96ft. on the underlie of the lode, which is to the N.E. at an angle of 70deg. At 90ft. is water level, and a supply of good drinking water, making at the rate of 100galls. in 24 hours, is obtained.

From this shaft at the 76ft. level stoping has been carried on both ways along the strike of the lode, N.W. and S.E., but principally to the N.W. Also on M.L. 1732, 118ft. to the N.W. of Fels' Shaft, the Central Shaft was being sunk to connect with the workings from Fels' Shaft. This shaft goes down 36ft. vertically on the hanging wall side, until it passes through the vein, from which point it is continued in the footwall country on the underlie of the lode, and will be eventually connected with the 76ft. level from Fels' Shaft.

The strike of the lode is S. 35deg. E. at the S.E. end, and S. 37deg. E. at the N.W. end.

The lode being worked is a fissure lode of tabular habit, cutting across the country, and affected by step-faulting, which in depth occasionally throws the lode a foot or a few feet to the E.

The lode varies in width from 8in. to 16in., with exceptionally an increase to as much as 26in. The country rock is an iron-stained silicified slate, which strikes S. 30deg. E., covered on all cleavage and fracture planes with dendritic markings of great variety (manganese), and in places showing a pitted texture.

The lode formation is ferruginous and calcareous, varying from siderite, or carbonate of iron, to calcite, and contains a variety of copper minerals, chalcopyrite chalcocite or grey ore, bornite (peacock ore), cuprite, atacamite, and malachite. The siderite is in places decomposed to a gossan, which generally carries very good ore.

A fair amount of gypsum shows in places, and some travertine formation.

The lode is a small one, but continuous and compact, and requires but little dressing. It is well suited for working by a small party, as at present.

The ore is being sent to the smelters.

At the N.W. end of the lode, on the side of the hill away from the Nob, is an open cutting known as Ogilvie New Gold Find, where a certain amount of gold ore was obtained.

BIG LODE COPPER MINE.

(*Vide* Review No. 9.)

Formerly known as Mont Pelee, comprises M.C. 10116, situated about 2½ miles E. of Nichol's Nob, on a hill of moderate elevation.

A certain amount of superficial work has been done here, the principal being an open cutting into the side of the hill, the face of which is 16ft. in

height, and a small shaft 12ft. in depth. The present holder is engaged principally in resorting the old dumps, the bagged ore being sent by team to Lyndhurst Siding, about 24 miles distant, thence by rail to Wallaroo. The hill is covered in most parts with massive boulders of ironstone, with silicified ferruginous slate. The iron stone is dense in texture in some places, in others decomposed to a gossan, and shows the presence of a little manganese occasionally. There is a certain amount of gypsum and travertine present.

The ironstone appeared to be a silicified lateritic capping through which copper minerals are disseminated in places

These minerals comprise malachite and atacamite, with a little chrysocolla or pale-blue silicate of copper, and are to be found in many places over the surface of the hill. Also a little chalcopyrite was seen. It would appear likely that in arid regions such as these copper minerals may be drawn by capillarity to the surface and distributed over large areas there although the sources of supply or lodes may be but of small size themselves.

It would therefore be well to guard against assuming that the width over which copper minerals show on the surface is the width of a lode, unless proved by underground development.

MOUNT BURR MINE.

(*Vide* Mining Record, p. 86, and Reviews Nos. 9 and 10.)

Two claims are held here, the Mount Burr Mine, M.C. 10530, and an adjoining claim, M.C. 10561, to the S. One man was working on the Mount Burr Mine, but no work was being done on the adjoining block.

On M.C. 10530, there are two distinct formations approximately parallel, and some distance apart, the strike being N.E. and S.W.

The more southerly of the two is that which was worked as the Mount Burr Mine, and a considerable amount of work has been done here, mostly of a superficial nature in the form of open cuttings, though there are some underground workings which could not be inspected.

These workings are mostly in quartzite and coarse quartz grit.

The other formation N.W. of this is in ferruginous silicified slate. It strikes with the slates, N.E. and S.W., and dips to the S.E. at an angle of 60deg.

Two seams of ore occur in this formation, the larger of which averages about 12in. in width, the smaller, parallel to it, and separated from it by about 1ft. of gangue, being 3in. or 4in. in width.

This lode shows on the lower slope of a range of hills, and can be traced for some distance. The owner has trenched along the outcrop of the lode for a considerable distance, and down to a depth of 10ft in places, and towards the S.W. end the ore vein increases to 20in. wide in one place. The copper minerals present are bornite and a little chalcopyrite, chalcocite, or grey ore and malachite and atacamite Vanadate of copper has also been observed here in small quantities.

The gangue is composed of calcitic siderite free from quartz as far as was seen.

It thus belongs to the rarer class of basic ores, and would be an acceptable ore for a smelter as against the more common siliceous ores, and would probably command a more favorable treatment rate.

Under these circumstances, ore dressing and picking has not to be carried to a great degree of refinement, and it was understood from the owner that ore as low as 4 per cent. would show a small profit.

BELLIAK MINE.

(*Vide* Reviews Nos. 9, 13, 25.)

Mineral claim No. 8730, situated about one mile W. of Mount Lyndhurst. A considerable amount of work has been done here, the principal working being a shaft part vertical, and part underlie, having a total depth of 150ft., from which a certain amount of stoping and driving has been carried on. The underlie portion of this shaft bears N. 20deg. E., and dips at an angle of 60deg.

The present owner has sunk a shaft a little distance away, some of the workings off which have broken through to the old workings about the 50ft. level

At the deep shaft the strike of the lode is E.S.E., and the dip is N.N.E., at an angle of 60deg.

A good deal of the ore obtained was sent to the smelting works, but later on the Lynda Company took the ore and carted it to the concentrating plant at the Lynda Mine.

There is no water at the mine, any used would have to be carted from other places, such as Mundy Dam.

The country is a fairly soft bluish-grey slate, with but little quartz.

The ore forms the filling of small fissures mostly cutting across the country, and not apparently of much size or persistence.

Stains of copper vanadate were seen here in places.

GREAT MOUNT LYNDHURST.

(*Vide* Mining Record, p. 88, and Review No. 9.)

Situated on the side of a hill, 1½ miles E.N.E. from Mount Lyndhurst. There are a large number of old workings here, none of which have attained any depth, many of them consisting simply of small shallow shafts with a little stoping off them.

An adit has been driven into the hill connecting with one of these shafts and passes through decomposed and bleached clay slates. A heading off this adit shows a 2in. seam of quartz with copper minerals, while in another heading opposite, about 4ft. of ground shows a number of quartz veins associated with some oxidised copper minerals. The end of the adit is in slate striking a little S. of E.

No water was obtained here, and the ore was hand dressed and sold to the smelters.

The occurrence of the ore here appears to be associated with numerous quartz veins of small size, and not of great persistence, and as at some of the other properties in the district, a little copper vanadate was noticed in places.

No work was being carried on.

LAST CHANCE MINE.

(*Vide* Review No. 9.)

This consists of a series of shallow workings and open cuttings, showing the oxidised copper minerals disseminated through the clay slates. It is situated close to the Belliak Mine, and is very similar in appearance and in the occurrence of the ore. One man was working partly here, and partly at the Belliak.

MOUNT FITTON SOUTH.

(*Vide* Mining Record, p. 89, and Reviews Nos. 9, 13.)

This property, M.C. 10571, is situated 3½ miles S. of Mount Fitton, on some hills on the southern side of Hamilton Creek.

An adit has been driven into the hill for some distance, and a considerable amount of work done from this.

A shaft connects with it, and stoping has been carried on for a length of 70ft., the width of the stope ranging from 8ft. to 20ft. Below the adit level a couple of winzes have been sunk, and a large chamber stoped out.

The ore occurs in seams and bunches in a pegmatite formation, the dip in places being E.S.E. at an angle of 50deg., and the copper minerals are chiefly grey ore or chalcocite, and some atacamite and covellite.

The ore is broken and hand dressed, and sold to the smelters.

A concentrating plant, comprising a crusher and jig, was erected here and an attempt made to concentrate the ore, but as was to be expected in handling rich secondary ores, was not a success, the loss in the tailing being too great. One man was engaged in mining here.

The writer was shown a specimen of scheelite, which was said to have come from the stope below tunnel level.

At the Hamilton Mine, about a mile to the eastward, a little copper ore was being obtained at the time of visiting. Specimens showing small particles of free gold were also seen in the neighborhood.

BILLY SPRINGS MINE.

(*Vide* Mining Record, p. 89, and Reviews Nos. 9, 24.)

(Situated two miles S. of Billy Springs.)

A good deal of work has been done here, open cutting and shaft sinking, one shaft being 100ft. in depth.

The formation is a ferruginous one, about 3ft. wide, having a strike of S. 70deg. E., and dipping N.E. at an angle of 60deg. The ore, however, is a complex one, containing copper, lead, zinc, and silver, and there does not appear to be any hope of treating it at a profit. If the deposit were very large there might be a chance of doing something with it, but a comparatively small body like this, with such a complex ore, appears hopeless.

There is no water here, and no one was working at the time, though a large amount of ore is on the surface, part stacked and part bagged. A large formation of tremolite, a variety of amphibole, 10ft. wide, and extending for a considerable distance, was observed a little S. of the mine.

MOUNT ROSE MINE.

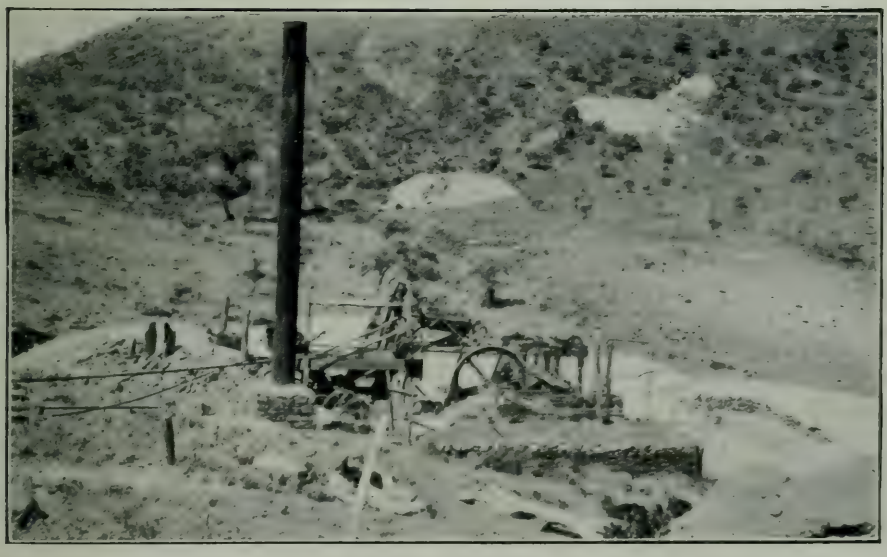
(*Vide* Mining Record, p. 95, and Reviews Nos. 16, 22, 25.)

Situated four miles E. of the Frome River, on the main track from Copley (Leigh Creek) to Yudnamutana, and about 40 miles by road E.N.E. of Copley.

The ore here was said to occur in pipe-like veins, and was characterised by the presence of a considerable amount of iron pyrites. A reverberatory smelter was erected, but apparently did not treat much ore.

The main shaft is said to be 200ft. in depth, and a good flow of water was obtained. A leaching plant had been in operation in the attempt to leach copper from the dump material, but had apparently been shut down and no work was proceeding at the time of visiting.

SLIDING ROCK COPPER MINE.



MOUNT FITTON SOUTH AND OLD CONCENTRATION PLANT.

To face p. 80.]

PAULL'S CONSOLIDATED COPPER MINE.

(*Vide* Mining Record, p. 116, and Reviews Nos. 8, 9, 13, 17, 19, 20, 22, 24.)

Situated also on the main road from Copley to Yudnamutana, 16 miles W. of Mount Rose Mine, and 24 miles by road N.E. of Copley.

Comprises M. leases 2131, 2132, situated on the southern slopes of an E.W. range of hills.

According to previous reports, a large amount of work has been done here, the main shaft having been sunk on the underlie to 300ft. The mine was not being worked at the time, the owner being on military service, and no inspection of the underground workings could be made. The ore appears to occur as small veins of rich oxidised and secondary copper minerals in clay slate, and has considerable lateral extent.

A concentrating mill, consisting of rockbreaker, rolls, jig, buddle, &c., was in operation here at one time, but apparently with no more success than was to be expected in attempting to treat such ores by this method.

Similarly situated on a parallel range, about a mile to the north, is PAULL'S NORTH MINE, which was also idle. No work was being carried on at the AJAX COPPER MINE, or the COPPER KING OCHRE SHOW. This latter mine has a series of shallow open workings showing ochre of various tints.

COPPER QUEEN.

(*Vide* Reviews Nos. 9, 10, 13, 14, 15, 16, 18, 19, 22, 24.)

Sometimes known as the Beltana Rapid Ore Treatment Mine. Situated five miles by road W.S.W. of Beltana, on the track to Ediacara. Comprises mineral claims 10573 and 10574. The mineralization here is of some width, showing principally green carbonate of copper distributed throughout a kaolinized formation with a considerable amount of sugary quartz.

The deposit appears to be mainly a low-grade one not suitable for hand dressing.

An attempt was made to treat the ore by leaching with steam heated solutions of sulphuric acid.

For this purpose a small plant, consisting of a boiler and small engine, three head of 200lb. stamps, solution vats, &c., was placed on the mine, and some ore was treated. The stamps were said by the owner to be rather light for crushing the quartzitic portion of the ore, and the plant was not in operation at the time of visiting.

There is also a certain amount of lime present in the formation which would consume additional acid.

There is a good vertical shaft down to water level at 82ft., equipped with a small hoisting engine.

Traces of vanadium ores were said to have been seen here.

BLACK EAGLE COPPER MINE.

(*Vide* Reviews Nos. 9, 10, 12, 13, 16, 17, 19, 22.)

Mineral claim 9430, adjoining the Ediacara Mine leases, about 19 miles by road W. of Beltana.

The claim is on the E. side of a range of hills of low elevation, and has been worked by means of adits.

There is a capping of large boulders of silicified ironstone, underlying which is a gossan formation.

Small seams and veins of copper ore, mainly malachite and atacamite, occur both in the boulders and in the softer formation beneath. A considerable amount of gypsum occurs, and some small seams of barytes were seen, and a considerable amount of calcitic material.

Some of the ore showed as impregnations in a brecciated formation, similar to occurrences at Ediacara Mine.

There are some fairly extensive workings from the adits, which are driven on the dip of the formation. No chalcopyrite was seen, but some slight stains of copper vanadate were noticed.

TWO JACKS, M.C. 10132, AND WARRIOOTA MINES, M.C. 10131.

(*Vide* Mining Record, p. 145, and Reviews Nos. 9, 10, 25.)

These two copper shows are about 10 miles by road E. of Beltana, on the Warrioota Creek, and no work was proceeding at either place.

At the Warrioota Mine the lode occurs as a nearly vertical fissure, cutting across soft grey calcareous slates, which dip at an angle of 20deg. to W.S.W. The vein filling is shattered quartz carrying grey ore and malachite in seams and patches. The lode, as seen in part of the workings, was 6ft. in width, and accompanied by a seam of soft clayey material on the wall.

SLIDING ROCK COPPER MINE.

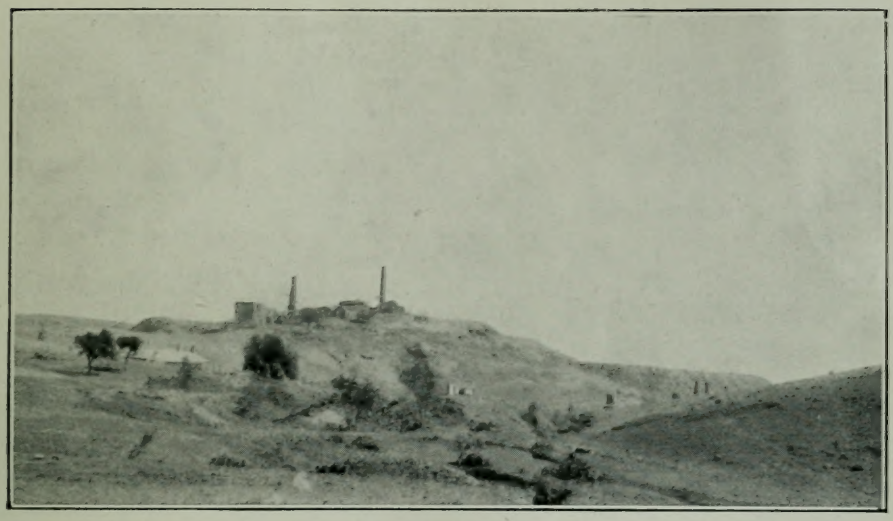
This old mine, of which a description is given in the Record of Mines, page 127, has been abandoned for some time, and is held by the Public Trustee.

The mine is full of water to within a few feet of the surface. The lode is said to have varied in width from 2ft. to 10ft., striking N. 20deg. E., and underlying to the E.

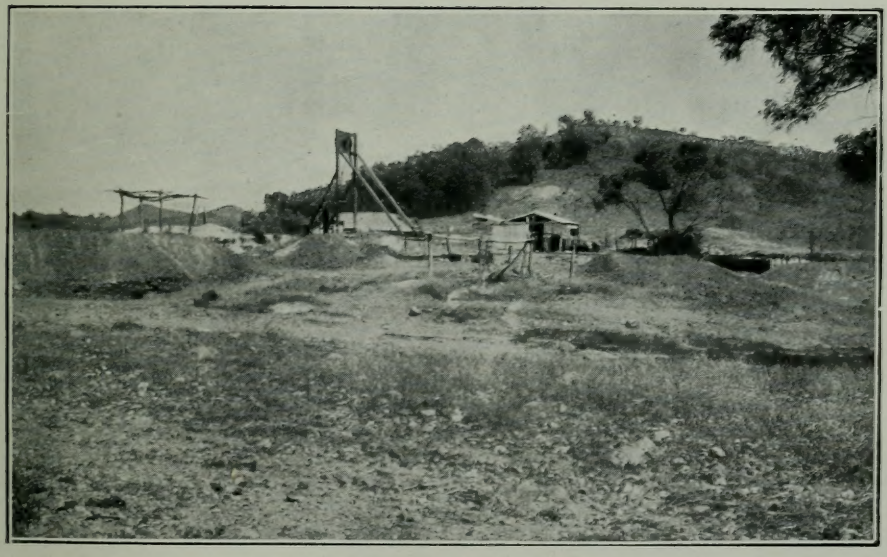
At Nuccaleena one man is engaged sorting over the old dumps.

The old Blinman Mine has been held for some time, and two men have been obtaining a certain amount of ore from the old workings.

Practically all the machinery and plant have been disposed of, and the main shaft, with some accompanying ore bins, &c., was destroyed by fire some time ago. (3-1-18.)



BLINMAN COPPER MINE.



MOUNT ROSE COPPER MINE.

To face p. 82.]